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ABSTRACT

This curriculum guide, written at the Arizona Vocational Educator's Curriculum Academy during July and August, 1985, was developed to complement the Arizona validated competency lists for construction trades. The writing team included tradespeople, secondary vocational educators, community college vocational instructors, and university professors of construction technology programs. This guide lists 12 competencies to be mastered by entry-level plumbers. For each competency, various tasks with their standard of performance, conditions for performance, source of the standard, and a performance guide are provided. These materials are intended to assist teachers in secondary and postsecondary vocational programs in developing a course of study, structuring learning sequences, determining standards of performance, and locating resources. The guide also contains a list of tools for a plumber's basic tool kit, references, and a matrix of plumbing competencies. (KC)

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PLUMBING CURRICULUM

BY

CHARLOTTE PRICKETT
PROJECT DIRECTOR

U.S. DEPARTMENT OF EDUCATION
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FOREWORD

The following materials were written at the Arizona Vocational Educator's Curriculum Academy during July and August, 1985. The Plumbing competencies, performance objectives, standards and sample performance guides were developed to complement the Arizona validated competency lists for Construction Trades. The writing team included tradespeople, secondary vocational educators, community college vocational instructors and university professors of construction technology programs.

These materials are provided for use in secondary and postsecondary vocational programs to assist teachers in developing course of study, structuring learning sequences, determining standards of performance and locating resources.

In the constantly changing state of construction trades technology, no claim can be made that these materials will ever by truly complete. However, it is the hope of the Academy contributors that instructors will use these materials to enhance the quality of Vocational Education throughout Arizona.

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In the development of this document the contributions of the following individuals were greatly appreciated:

Writing Team:

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In addition, we are grateful to Kathy Dunn for her leadership and assistance in getting the final curriculum guide edited and printed.

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EXECUTIVE SUMMARY

This document describes building trades curriculum in the following four areas: plumbing, masonry, carpentry, and electrical. For the development of these curriculum materials a group of teachers were selected to convene in Flagstaff, Arizona for a two week Curriculum Academy in July and August, 1985 at the Arizona Center for Vocational Education. The major purpose of the academy was to review the ARizona validated listings of competencies and tasks in building trades and to, then, write curriculum components to support each competency and task. Under the leadership of Dr. Barbara Gutheil, Dr. Linda Loomis, and Charlotte Prickett, teachers from both the secondary and postsecondary educational levels met and sifted through the existing listings of validated competencies and tasks and then further developed the curriculum components. For each competency and task a standard of performance, condition for performance of the task, source of the standard, and performance guide was developed. We hope that you will find these materials both helpful and meaningful to your students and to your vocational building trades program.

COMPETENCY: 1 Apply safety principles for a safe working environment

---

PERFORMANCE OBJECTIVE 1.1

TASK: Demonstrate hand tool safety.

STANDARD OF PERFORMANCE OF TASK:

Demonstrated tool safety by using tool for intended purpose, per industry practice.

Displays positive safety attitude, as determined by job supervisor.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Plumber standard tool kit
Examples of hand tool safety

PERFORMANCE GUIDE:

1. Select proper hand tool for job at hand.
2. Make sure tools with cutting edges are sharp.
3. Batter-heads of metal tools, must be kept ground smooth to avoid mushrooming.
4. Do not strike hardened metal tools, with a hard faced hammer.
5. Pipe wrenches should be in good conditions, and have good jaws, and placed in proper direction of force.
6. Always use a handle on a file.

COMPETENCY: 1 Apply safety principles for a safe working environment

---

PERFORMANCE OBJECTIVE 1.2

TASK: Demonstrate tool and equipment safety.

STANDARD OF PERFORMANCE OF TASK:

Demonstrated tool and equipment safety by using for intended purpose, per industry practice.

Demonstrates positive safety attitude, as determined by supervisor.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Standard plumber tool kit
Plumbing equipment
Examples of safe tool and equipment usage

PERFORMANCE GUIDE:

1. Do not attempt to use any electrically powered tools or equipment without knowing their principles of operation, methods of use, and general and special safety precautions.
2. Extension cords and power tool cords are not to be used to raise and lower the tools from ladders or scaffolding.
3. Report defective power tools and remove them from the job site.

COMPETENCY: 1 Apply safety principles for a safe working environment

---

PERFORMANCE OBJECTIVE 1.3

TASK: Demonstrate work area safety practices.

STANDARD OF PERFORMANCE OF TASK:

Heeded hazard warning signs.
Followed good housekeeping procedures.
Observed work area safety practices, as determined by job supervisor.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Work area
Safety orientation
Exposure to industry safety practices

PERFORMANCE GUIDE:

1. Basic rules for safe work in trenches:
    a. Do not pile excavated material on sidewalks, walkways, or within 2 feet of the trench excavation.
    b. Trenches more than 5 feet deep in hard or compacted soil, must be shored or sloped to the angle of repose of the soil.
    c. Trenches less than 5 feet deep in ground where hazardous conditions exist, must be shored or sloped.
    d. Portable trench boxes may be used instead of shoring or sloping the trench if they provide equal or better protection.
    e. A ladder must be provided for entering or leaving the trench at every 25 ft. of length, if the trench is more than 4 feet in depth.

COMPETENCY: 1 Apply safety principles for a safe working environment

---

PERFORMANCE OBJECTIVE 1.4

TASK: Demonstrate power equipment safety.

STANDARD OF PERFORMANCE OF TASK:

Demonstrated power equipment safety, by using for intended purposes, per industry practices.

Adjustable pipe supports should be used when handling long lengths of pipe with power equipment.

Plumbing power equipment must be properly maintained, to insure safe operation.

Displays positive safety attitude, as determined by supervisor.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Typical plumber power equipment
Power equipment safety orientation
Information on industry safety practices
Examples of power equipment safe usage

PERFORMANCE GUIDE:

COMPETENCY: 1 Apply safety principles for a safe working environment

---

PERFORMANCE OBJECTIVE 1.5

TASK: Demonstrate gas safety.

STANDARD OF PERFORMANCE OF TASK:

Heeded hazard warning signs.

Performed work safely, as determined by job supervisor.

Store gas cylinders in an upright position, in an area away from extreme heat, fire hazards, and traffic. Chain or rope cylinders to a column or wall to keep them from tipping.

Cylinder cap should always be on the tank when it is being stored or moved.

Always move a cylinder by rolling it on its bottom edge.

Demonstrates positive safety attitude, as observed by supervisor.

SOURCE OF STANDARD: OSHA
Writing Team
Associated Builders and Contractors
1984, p. 2, 3

CONDITIONS FOR PERFORMANCE OF TASK:

Gas safety orientation
Examples of safe usage of gases
Given a situation where gas safety must be observed
Proper attire/equipment for demonstrating gas safety

PERFORMANCE GUIDE:

COMPETENCY: 1 Apply safety principles for a safe working environment

---

PERFORMANCE OBJECTIVE 1.6

TASK: Demonstrate toxic substances safety.

STANDARD OF PERFORMANCE OF TASK:

Heeded hazard warning signs.

Followed safety information, as determined by job supervisor.

Demonstrates positive safety attitude, as observed by supervisor.

SOURCE OF STANDARD: OSHA
Writing Team
Associated Building & Contractors
1984, p. 2, 3

CONDITIONS FOR PERFORMANCE OF TASK:

Toxic substances safety orientation
Examples of safe handling of toxic substances
Given a situation where toxic substances must be handled
Proper attire/equipment for demonstrating toxic substance safety

PERFORMANCE GUIDE:

1. Learn the characteristics of all the chemicals to be used in plumbing operations.
2. Label properly and store in safe area.
3. Drain cleaning chemicals. Carefully handle to prevent burns to skin and eyes.
4. Wear proper breathing apparatus, when working around hazardous dust, gases, or vapors.

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COMPETENCY: 1 Apply safety principles for a safe working environment

---

PERFORMANCE OBJECTIVE 1.7

TASK: Demonstrate heating devices and hot materials safety.

STANDARD OF PERFORMANCE OF TASK:

Observed caution warning signs.
Followed safe procedure, as determined by supervisor.

SOURCE OF STANDARD:
Writing Team
OSHA
Associated Building & Contractors
1984, p. 5, 6

CONDITIONS FOR PERFORMANCE OF TASK:

Orientation on heating devices and hot materials safety
Examples of safe usage of heating devices and hot materials
Proper attire/equipment for demonstrating heating devices and hot material safety
Given a situation where safety must be observed

PERFORMANCE GUIDE:

1. Always wear gloves when working with hot lead or when soldering or welding.
2. When working with lead, preheat any frozen or wet lead before adding it to the molten pot.
3. Lead furnaces should be placed on a flat stable surface so that they will not tip and spill the pot of molten lead.

COMPETENCY: 1 Apply safety principles for a safe working environment

---

PERFORMANCE OBJECTIVE 1.8

TASK: Demonstrate gas burners and flammables safety.

STANDARD OF PERFORMANCE OF TASK:

Heeded hazard and caution warning signs.
Demonstrated safe usage, as determined by job supervisor.

SOURCE OF STANDARD: Writing team
OSHA
Associated Building and Contractors
1984, p. 5, 6

CONDITIONS FOR PERFORMANCE OF TASK:

Safety orientation on gas burners and flammables
Example of safe usage of gas burners and flammables
Proper attire/equipment for demonstration of gas burner and flammable safety
Given a situation whereby safety must be observed

PERFORMANCE GUIDE:

1. Soldering and welding torches should be inspected daily to see that they are in good working condition and do not leak.
2. Flammable liquids and materials must be properly labeled and stored in fire resistant containers.

COMPETENCY: 1 Apply safety principles for a safe working environment

---

PERFORMANCE OBJECTIVE 1.9

TASK: Demonstrate electrical hazards safety.

STANDARD OF PERFORMANCE OF TASK:

Heeded hazard warning signs and labels.

Demonstrated a positive safety attitude toward hazards, as determined by supervisor.

SOURCE OF STANDARD: Writing team
OSHA
Associated Builders and Contractors
1984, p. 4, 6

CONDITIONS FOR PERFORMANCE OF TASK:

Safety orientation on electrical hazards
Examples of potential electrical hazards
Given a situation where electrical hazards exist

PERFORMANCE GUIDE:

1. Make sure all power tools are either of the approved double-insulated type, or that they have non-defective three wire grounded type cords.
2. Never connect electrical equipment to a power source unless the switch is in the off position.
3. Do not leave extension cords lying where they will be pinched in doors or run over and damaged by equipment or scaffold wheels.

COMPETENCY: 1 Apply safety principles for a safe working environment

---

PERFORMANCE OBJECTIVE 1.10

TASK: Demonstrate moving heavy objects safety.

STANDARD OF PERFORMANCE OF TASK:

Followed lifting and hauling procedures.

Demonstrated a positive safety attitude, as observed by supervisor.

SOURCE OF STANDARD: Writing team
OSHA
Associated Builders and Contractors
1984, p. 3

CONDITIONS FOR PERFORMANCE OF TASK:

Safety orientation on moving heavy objects
Examples how to safely move heavy items
Given a situation where a heavy object is to be moved

PERFORMANCE GUIDE:

1. Keep your arms and body as nearly straight as possible when lifting heavy objects. Bend your knees, squat, and keep your back as straight as possible. Lift with the legs -- not the back. If the object is too heavy or too bulky, get help.
2. Use proper tools when handling heavy pipe and equipment. Do not overload the tools.
3. Use proper rigging methods and materials.

COMPETENCY: 1 Apply safety principles for a safe working environment

---

PERFORMANCE OBJECTIVE 1.11

TASK: Demonstrate work platform safety.

STANDARD OF PERFORMANCE OF TASK:

Followed safety examples, as observed by job supervisor.

Demonstrated work platform safety as determined by supervisor.

SOURCE OF STANDARD: Writing team
OSHA
Associated Builders and Contractors
1984, p. 8, 9

CONDITIONS FOR PERFORMANCE OF TASK:

Work platform safety orientation
Examples of work platform safety
Given a situation where work is to be performed on a platform

PERFORMANCE GUIDE:

1. Rolling scaffolds should be equipped with large strong wheels, provided with locks.
2. Never move a rolling scaffold while workers are on the scaffold.
3. All planks on rolling scaffold should be securely fastened so that they will not slide off while scaffolds are moved.

COMPETENCY: 2 Assemble and demonstrate use and care of tools and equipment needed for plumbing tasks

---

PERFORMANCE OBJECTIVE 2.1

TASK: Determine tools and equipment required for specific jobs.

STANDARD OF PERFORMANCE OF TASK:

All tools and equipment required for a specific job are present when job begins or are schedule to arrive as needed.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Given job requiring tools
Standard plumber's tool kit

PERFORMANCE GUIDE:

COMPETENCY: 2 Assemble and demonstrate use and care of tools and equipment needed for plumbing tasks

---

PERFORMANCE OBJECTIVE 2.2

TASK: Clean tools and equipment required for specific jobs.

STANDARD OF PERFORMANCE OF TASK:

Tools and equipment used and soiled are promptly cleaned.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Tools and equipment used in plumbing jobs

PERFORMANCE GUIDE:

COMPETENCY: 2 Assemble and demonstrate use and care of tools and equipment needed for plumbing tasks

---

PERFORMANCE OBJECTIVE 2.3

TASK: Load trucks with tools, equipment, and supplies.

STANDARD OF PERFORMANCE OF TASK:

All tools, equipment and supplies are orderly and securely stowed on the truck.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Trucks	Tools
Equipment	Supplies

PERFORMANCE GUIDE:

COMPETENCY: 2 Assemble and demonstrate use and care of tools and equipment needed for plumbing tasks

---

PERFORMANCE OBJECTIVE 2.4

TASK: Maintain tools in proper working order.

STANDARD OF PERFORMANCE OF TASK:

Tools and equipment are properly adjusted, sharp (if applicable), in good repair and in safe condition for use.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Plumbing tools and equipment
Needed parts for renewal
Maintenance tools

PERFORMANCE GUIDE:

COMPETENCY: 2 Assemble and demonstrate use and care of tools and equipment needed for plumbing tasks

---

PERFORMANCE OBJECTIVE 2.5

TASK: Maintain security of tools, equipment, and supplies.

STANDARD OF PERFORMANCE OF TASK:

Tools, equipment and supplies are not missing or stolen.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Tools	Equipment
Supplies	Tool boxes

PERFORMANCE GUIDE:

COMPETENCY: 2 Assemble and demonstrate use and care of tools and equipment needed for plumbing tasks

---

PERFORMANCE OBJECTIVE 2.6

TASK: Secure and maintain personal equipment and tools.

STANDARD OF PERFORMANCE OF TASK:

Personal tool boxes and tools are clean, in good operating condition and are kept in sight or stored in a secure location.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Tools	Tool boxes

PERFORMANCE GUIDE:

COMPETENCY: 2 Assemble and demonstrate use and care of tools and equipment needed for plumbing tasks

---

PERFORMANCE OBJECTIVE 2.7

TASK: Store tools, equipment, and supplies.

STANDARD OF PERFORMANCE OF TASK:

Tools, equipment, and supplies are neatly stored in assigned secure locations.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Tools	Equipment
Supplies	Storage space

PERFORMANCE GUIDE:

COMPETENCY: 2 Assemble and demonstrate use and care of tools and equipment needed for plumbing tasks

---

PERFORMANCE OBJECTIVE 2.8

TASK: Use power-driven vise stands.

STANDARD OF PERFORMANCE OF TASK:

Worked materials, per work specifications.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Power-driven vise stand
Materials to be worked
Work specifications
Proper work attire

PERFORMANCE GUIDE:

COMPETENCY: 2 Assemble and demonstrate use and care of tools and equipment needed for plumbing tasks

---

PERFORMANCE OBJECTIVE 2.9

TASK: Use hand sewer and drain cleaning apparatuses.

STANDARD OF PERFORMANCE OF TASK:

Cleared stoppage using standard procedure, as determined by supervisor.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Given a situation where a stoppage is in a waste system.
Standard plumber's tool kit.
Hand sewer and drain cleaning equipment.

PERFORMANCE GUIDE:

COMPETENCY: 2 Assemble and demonstrate use and care of tools and equipment needed for plumbing tasks

---

PERFORMANCE OBJECTIVE 2.10

TASK: Use pipe cutters.

STANDARD OF PERFORMANCE OF TASK:

Performed operation in ten minutes or less.
Correct usage, per specifications.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Standard plumber's tool kit
Pipe and pipe cutters
Proper attire/equipment
Work specifications

PERFORMANCE GUIDE:

COMPETENCY: 2 Assemble and demonstrate use and care of tools and equipment needed for plumbing tasks

---

PERFORMANCE OBJECTIVE 2.11

TASK: Use plumb bobs and lines.

STANDARD OF PERFORMANCE OF TASK:

Performed operation, per plans and specifications.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Standard plumber's tool kit
Plumb bob and lines
Given a situation of setting upright pipe stand and drain
Work plans and specifications

PERFORMANCE GUIDE:

COMPETENCY: 2 Assemble and demonstrate use and care of tools and equipment needed for plumbing tasks

---

PERFORMANCE OBJECTIVE 2.12

TASK: Use power drill.

STANDARD OF PERFORMANCE OF TASK:

Drilled materials, per work specifications.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Power drill
Material to be drilled
Work specifications

PERFORMANCE GUIDE:

COMPETENCY: 2 Assemble and demonstrate use and care of tools and equipment needed for plumbing tasks

---

PERFORMANCE OBJECTIVE 2.13

TASK: Use dies to thread pipe.

STANDARD OF PERFORMANCE OF TASK:

Followed specifications and completed operation in ten minutes or less.

SOURCE OF STANDARD: Plumbing, 1976, p. 17

CONDITIONS FOR PERFORMANCE OF TASK:

Standard plumber's tool kit
Steel pipe and dies
Work order specifications

PERFORMANCE GUIDE:

COMPETENCY: 2 Assemble and demonstrate use and care of tools and equipment needed for plumbing tasks

---

PERFORMANCE OBJECTIVE 2.14

TASK: Use power grinders.

STANDARD OF PERFORMANCE OF TASK:

Materials ground, per work specifications.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Power grinder
Material to be ground
Work specifications
Proper work attire

PERFORMANCE GUIDE:

COMPETENCY: 2 Assemble and demonstrate use and care of tools and equipment needed for plumbing tasks

---

PERFORMANCE OBJECTIVE 2.15

TASK: Use power saws.

STANDARD OF PERFORMANCE OF TASK:

Materials cut, per work plans and specifications.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Power saw
Materials to be cut
Work plans and specifications
Proper work attire/equipment

PERFORMANCE GUIDE:

COMPETENCY: 2 Assemble and demonstrate use and care of tools and equipment needed for plumbing tasks

---

PERFORMANCE OBJECTIVE 2.16

TASK: Use power sewer and drain cleaning equipment.

STANDARD OF PERFORMANCE OF TASK:

Cleared stoppage, per work specifications.

Used standard procedures, as determined by job supervisor.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Standard plumber's tool kit
Power sewer and drain cleaning equipment
Proper work attire
Work specifications
Given situation where a stoppage occurs in a waste system

PERFORMANCE GUIDE:

COMPETENCY: 3 Interpret drawings and specifications to determine work aids required and sequence of installations

---

PERFORMANCE OBJECTIVE 3.1

TASK: Read site plans.

STANDARD OF PERFORMANCE OF TASK:

Identify utility services for location, size, hook-up and depth or height of installation with 100% accuracy.

SOURCE OF STANDARD: Standard Industry Practices

Plumbing Installation and Design -- Chapter 12

CONDITIONS FOR PERFORMANCE OF TASK:

1. Site plan of residence requiring all utility services.
2. Architects' scale

PERFORMANCE GUIDE:

COMPETENCY: 3 Interpret drawings and specifications to determine work aids required and sequence of installations

---

PERFORMANCE OBJECTIVE 3.2

TASK: Read basement plans.

STANDARD OF PERFORMANCE OF TASK:

Identify material symbols, opening, fixtures, utility line entrances and dimensions from basement plan with 100% accuracy.

SOURCE OF STANDARD:

American Architects Standards
Unified Building Code
Standard Industrial Practices

Plumbing Installation and Design -- Chapter 12

CONDITIONS FOR PERFORMANCE OF TASK:

PERFORMANCE GUIDE:

COMPETENCY: 3 Interpret drawings and specifications to determine work aids required and sequence of installations

---

PERFORMANCE OBJECTIVE 3.3

TASK: Read floor plans.

STANDARD OF PERFORMANCE OF TASK:

Identify material symbols, openings, fixtures, and dimensions from floor plan of three bedroom house with 100% accuracy.

SOURCE OF STANDARD:

American Architectural Standards - 1984 Edition
Plumbing Installation and Design -- Chapter 12

CONDITIONS FOR PERFORMANCE OF TASK:

PERFORMANCE GUIDE:

COMPETENCY: 3 Interpret drawings and specifications to determine work aids required and sequence of installations

---

PERFORMANCE OBJECTIVE 3.4

TASK: Determine location of fixtures and equipment.

STANDARD OF PERFORMANCE OF TASK:

All fixtures and equipment shall be listed on a standard plumbing take-off form with 100% accuracy.

SOURCE OF STANDARD: Standard Industrial Practice
American Institute for Building Specifications
Plumbing Installation and Design -- Chapter 12

CONDITIONS FOR PERFORMANCE OF TASK:

1. Set of house plans and specifications with three bedroom house that has basement
2. Plumbing take-off form

PERFORMANCE GUIDE:

COMPETENCY: 3 Interpret drawings and specifications to determine work aids required and sequence of installations

---

PERFORMANCE OBJECTIVE 3.5

TASK: Scale building plans.

STANDARD OF PERFORMANCE OF TASK:

Lengths to be determined from a set of plans using an architects' scale; proper scale to correspond to scale of drawing with a tolerance of the smallest increment of each scale used.

SOURCE OF STANDARD: ANSI

Plumbing Installation and Design -- Chapter 12

CONDITIONS FOR PERFORMANCE OF TASK:

1. Set of house plans with drawings made to various scales
2. Architects' scale

PERFORMANCE GUIDE:

COMPETENCY: 3 Interpret drawings and specifications to determine work aids required and sequence of installations

---

PERFORMANCE OBJECTIVE 3.6

TASK: Draw piping plans.

STANDARD OF PERFORMANCE OF TASK:

Elevation drawing of system and/or isometric drawing of system drawn and indicating vent, waste and supply. Indicate piping sizes, fixture and equipment hook-up in proper sequence with 100% accuracy.

SOURCE OF STANDARD: National Plumbing Code

Plumbing Installation and Design -- Chapter 12

CONDITIONS FOR PERFORMANCE OF TASK:

1. Set of plans for three bedroom house.
2. Drawing pencil, paper and scale.
3. Eraser.

PERFORMANCE GUIDE:

COMPETENCY: 3 Interpret drawings and specifications to determine work aids required and sequence of installations.

PERFORMANCE OBJECTIVE 3.7

TASK: Determine amount and type of materials.

STANDARD OF PERFORMANCE OF TASK:

All piping, fittings, hangers and mise plumbing supplies listed on standard take-off form to nearest standard unit with tolerance of +/- 5%.

SOURCE OF STANDARD:

American Society for Testing and Materials (ASTM)
Plumbing Installation and Design -- Chapter 12

CONDITIONS FOR PERFORMANCE OF TASK:

1. House plans and specifications for three bedroom residential plan
2. Plumbing take-off form
3. Architects' scale

PERFORMANCE GUIDE:

COMPETENCY: 3 Interpret drawings and specifications to determine work aids required and sequence of installations

---

PERFORMANCE OBJECTIVE 3.8

TASK: Identify and define piping symbols.

STANDARD OF PERFORMANCE OF TASK:

Symbols for pipe and fittings for supply, waste, and vent systems shall be identified with 100% accuracy.

SOURCE OF STANDARD:

National Standard Plumbing (ASTM)
Plumbing Installation and Design -- Chapter 12

CONDITIONS FOR PERFORMANCE OF TASK:

PERFORMANCE GUIDE:

COMPETENCY: 4 Perform measurement and calculations for plumbing pipe connections and seals to operate within local plumbing code

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PERFORMANCE OBJECTIVE 4.1

TASK: Identify and use steel tape rule.

STANDARD OF PERFORMANCE OF TASK:

Identify steel tape for specific need (100% accuracy).
Measurements to be made to the nearest 1/16" (unless other tolerance specified).
Measurement mark clearly visible.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Flexible steel tape
Pencil
Lengths of pipe to be measured

PERFORMANCE GUIDE:

COMPETENCY: 4 Perform measurement and calculations for plumbing pipe connections and seals to operate within local plumbing code

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PERFORMANCE OBJECTIVE 4.2

TASK: Identify and explain pipe measurements and sizes.

STANDARD OF PERFORMANCE OF TASK:

Utilize tables to select proper pipe sizes and lengths with 85% accuracy.

Measure pipe: end to end, end to center, center to center.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Tables of pipe sizes (steel, copper, plastic)

PERFORMANCE GUIDE:

COMPETENCY: 4 Perform measurement and calculations for plumbing pipe connections and seals to operate within local plumbing code

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PERFORMANCE OBJECTIVE 4.3

TASK: Perform basic math computations using whole numbers, decimals, and fractions.

STANDARD OF PERFORMANCE OF TASK:

Solve math problems using whole numbers, decimals and fractions with 85% accuracy.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Typical plumbing math problems
Paper and pencil
Calculator

PERFORMANCE GUIDE:

COMPETENCY: 4 Perform measurement and calculations for plumbing pipe connections and seals to operate within local plumbing code

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PERFORMANCE OBJECTIVE 4.4

TASK: Make measurements using standard units such as feet and inches.

STANDARD OF PERFORMANCE OF TASK:

Accuracy of measurements must be within 1/16".

SOURCE OF STANDARD:

Mid America Residential Plumbing, Part 1

CONDITIONS FOR PERFORMANCE OF TASK:

Six foot folding rule
Flexible steel rule
Lengths of pipe

PERFORMANCE GUIDE:

COMPETENCY: 4 Perform measurement and calculations for plumbing pipe connections and seals to operate within local plumbing code

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PERFORMANCE OBJECTIVE 4.5

TASK: Calculate fitting allowances.

STANDARD OF PERFORMANCE OF TASK:

Calculate center to center distances for specific types and size of pipe for given run to +- 1/16".

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Appropriate pipe and fittings
Plans and specifications
Paper and pencil
Fitting makeup tables

PERFORMANCE GUIDE:

COMPETENCY: 4 Perform measurement and calculations for plumbing pipe connections and seals to operate within local plumbing code

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PERFORMANCE OBJECTIVE 4.6

TASK: Calculate offsets.

STANDARD OF PERFORMANCE OF TASK:

Calculate end to end distance for specific type and size of pipe offset for given problem situation +- 1/16" (straight and rolling offsets).

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Appropriate pipe and fittings
Paper and pencil
Plans and specifications
Local plumbing code

PERFORMANCE GUIDE:

COMPETENCY: 4 Perform measurement and calculations for plumbing pipe connections and seals to operate within local plumbing code

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PERFORMANCE OBJECTIVE 4.7

TASK: Calculate pitches.

STANDARD OF PERFORMANCE OF TASK:

Calculation of pitch for given length of horizontal run according to pipe size and local code (+- 1/16").

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Paper and pencil
Plumbing code
Plans and specifications

PERFORMANCE GUIDE:

CALCULATE SLOPE/PITCHES:

1. A slope or grade of 2% of 1/4" per foot of horizontal sewer pipe is considered to be preferred amount of grade.
2. All vertical measurements or elevations are made from the inverts of pipes.
3. If invert elevation of sewer connection to be piped is known, the plumber can determine invert elevation of existing or proposed pipe at building wall and excavate, maintaining a uniform grade from point A to point B.
4. If invert elevation of sewer connection is not known, plumber should start trench at sewer connection.
5. Uncover sewer connection, determine elevation.
6. Check to see if sufficient grade of trench and sewer is obtainable.

COMPETENCY: 4 Perform measurement and calculations for plumbing pipe connections and seals to operate within local plumbing code

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PERFORMANCE OBJECTIVE 4.8

STANDARD OF PERFORMANCE OF TASK:

Test of assembly must show an absence of leaks.
Installation test sample must follow Uniform Plumbing Code in method of assembly and use of materials.

SOURCE OF STANDARD:

Plumbing Installation and Design, Chapter 11

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Sketches appropriate to plumbing materials
Standard plumber's tool kit
Pipe dies
Uniform Plumbing Code
Torch, solder, flux
Pipe cutters

PERFORMANCE GUIDE

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.1

TASK: Join asbestos-cement pipes.

STANDARD OF PERFORMANCE OF TASK:

Pipe must be free from cracks and must be smooth with a watertight joint.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5

CONDITIONS FOR PERFORMANCE OF TASK:

Asbestos cement piping
Assembly tool stirrup
Lubricant seal

PERFORMANCE GUIDE:

1. Determine the length and end of the pipe to be cut.
2. Mark the pipe in several places around its circumference.
3. Place marking material (soft plastic or leather belt or strip) around the pipe and mark the circumference.
4. Lay the pipe to be cut on a firm, level location, checked on both sides and at two ends so that it cannot move while cutting.
5. Using safety glasses, cut the pipe with simple hand tools, such as a hammer and chisel. Hack saw to cut reinforcing wire.
6. Score pipe around chalk mark with cold chisel and, tapping lightly with hammer, turn the pipe until it has been evenly scored all around.

   Note: A faster and more workman-like cut can be made with an electric saw using a "ductile" blade. Proper instruction in the use of an electric saw is necessary.

7. Inspect the concrete pipe for a smooth, even and square cut.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.2

TASK: Join cast iron pipes.

STANDARD OF PERFORMANCE OF TASK:
Pipe and fittings must be properly aligned, stable and leak free when filled with water under appropriate pressure.

SOURCE OF STANDARD:
Plumbing Installation and Design -- Chapter 5
Mid America Vocational Curriculum
Residential Plumber, Part 1

CONDITIONS FOR PERFORMANCE OF TASK:
Cast iron pipe to be joined
Standard plumber's tool kit
Block of wood
Lubricant or glue
Brush
Pipe stirrup, digging bar, neoprene gasket

PERFORMANCE GUIDE:

A. Join with lead and oakum:

1. Inspect and clean the cast-iron sections to be joined.
2. Insert the spigot end of one pipe into the hub of the joining pipe.
3. Wrap an oakum strand into the joint by hand so that the oakum makes a tight fit.
4. Continue to wrap the oakum strand to make three turns around the pipe.
5. Drive the strand of oakum to the bottom of the joint using a packing iron.
6. Pack the oakum solidly and evenly using a packing iron and hammer.
7. Pack additional strands of oakum into the joint until it fills the hub to within one (1) inch of the top.
8. Pour molten lead into the joint at one spot between the hub and spigot until it fills slightly above the top of the hub.
9. Allow the lead to cool.
10. Tap the lead down at 4 points equally spaced around the hub using a caulking iron.
11. Caulk the joint on the inside edges of the lead joint using an "inside" caulking iron and hammer.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.2 continued

TASK: Join cast iron pipes.

PERFORMANCE GUIDE continued:

12. Repeat the above step but this time along the outside edges using an "outside" caulking iron.
13. Check for proper grade and alignment.
14. Test the pipe for leaks with water.

B. Join using rubber-type seal:

1. Inspect the neoprene gaskets to confirm that they are smooth and free of pitting, cracks, blisters and foreign matter.
2. Remove any sharp edge that may exist on the spigot end of the pipe.

   Note: This can be done by peening or by lightly filing the edge. This will permit the pipe to slide more easily without tearing or cutting the gasket.

3. Insert the gasket into the hub making sure the retaining flange or collar of the gasket is adjacent to the face of the hub.
4. Apply a thin coat of lubricant or glue to the inside of the gasket and the outside of the spigot end of the pipe.
5. Align the spigot and hub to be joined.
6. Force the spigot end of the pipe into the gasket.

   Note: This can be accomplished by a pulling tool manufactured for this purpose or by any number of methods using a lever or driving block, or lead hammer.

7. Continue the force until the spigot end of the pipe is firmly seated against the bell end of the joining pipe.
8. Check for proper grade and alignment.
9. Test the pipe for leaks with water.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.2 continued

TASK: Join cast iron pipes.

PERFORMANCE GUIDE continued:

C. Join using no-hub connectors:

1. Use full lengths of cast-iron pipe or cut to the desired length.
2. Place the neoprene gasket on the end of one pipe and the stainless steel clamp assembly on the end of the other pipe.
3. Firmly seat the pipe ends against the integrally molded shoulder inside the neoprene gasket.
4. Slide the clamp assembly into position over the gasket.
5. Tighten the stainless steel bands alternately and firmly to 60 inch-pounds of torque.
6. Check for proper grade and alignment.
7. Test the pipe for leaks with water.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.3

TASK: Join clay pipes.

STANDARD OF PERFORMANCE OF TASK:

Pipe must be properly aligned, centered, stable and without leaks when filled with water.

SOURCE OF STANDARD: V-TECS: Plumber, 1984
Mid America Residenital Plumber, Part 1

CONDITIONS FOR PERFORMANCE OF TASK:

Clay pipes that need to be joined
Shovel and pick
Standard plumber's tool kit
Small finishing trowel
Mortar
Sand
Oakum
Packing iron

PERFORMANCE GUIDE:

1. Insert spigot end of pipe in the bell of the previously laid pipe.
2. Mark the location of the latest bell.
3. Remove pipe and dig a shallow bell hole so that the entire length of the pipe is resting on a firm foundation.
4. Reinsert the spigot into the bell and check the grade with a level.
5. Shim or block up a new length of pipe using thin slate until new pipe has proper grade and aligned in the old bell.
6. Pack strands of oakum in the joint leaving about three quarters to one inch of space for cement. Mix two parts sand and one part Portland cement.
7. Pack cement into the cavity of joint. Leave some cement on outside of joint.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.3 continued

TASK: Join clay pipes.

PERFORMANCE GUIDE:

8. Smooth entire joint with trowel leaving a slight bevel from pipe to outer edge of bell.
9. Remove any wet cement from inside of pipe.
10. Let cement mix in joint become dry or set before backfill if possible. (Clay pipe requires special backfill procedures).

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.4

TASK: Join dissimilar pipes.

STANDARD OF PERFORMANCE OF TASK:
Pipe must be standard and properly aligned, stable and leak free when filled with water. PVC must not be cracked or burned.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Cast iron pipe which must be joined to PVC
Coupling for that purpose
Lead and oakum
Furnace and lead pot
Caulking tools

PERFORMANCE GUIDE:

A. Join cast-iron pipe to clay pipe:

1. Lay pipe to proper grade.
2. Make sure pipes are in proper alignment.
3. Pack oakum in large annular space between cast-iron pipe and bell of clay pipe until about one inch of space is left.
4. Mix sand and cement into stiff consistency.
5. Pack cement mix into space left with hands protected by wearing plastic coated gloves.
6. Smooth join with trowel, leaving a slight bevel from outside of cast-iron pipe to outside edge of clay bell.
7. Prevent or remove any spilled cement mix from inside of pipe.

ALTERNATE METHOD:

1. Select proper size and type of flexible elastomeric PVC coupling and install as per manufacturer's recommendations.

B. Join transite pipe to cast-iron pipe:

1. Transite (asbestos/cement) pipe may be joined to cast iron pipe of the size using a lead and oakum joint.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.4 continued

TASK: Join dissimilar pipes.

PERFORMANCE GUIDE continued:

2. For a quicker, cheaper installation, flexible elastomeric PVC couplings, "donuts", gaskets and "O" rings are available.
3. When transite pipe is of the same nominal size as the cast iron pipe, a gasket or "donut" may be inserted fully into the bell or the hub of the cast iron pipe.

GASKET METHOD:

1. Lubricate the inside of the gasket and the outside of the transite pipe.
2. Push the transite pipe fully into the cast iron bell until it bottoms.

Hints: a. Proper alignment will help prevent damage to transit pipe while pushing into place.

b. When the transite pipe is of a smaller nominal size than the iron pipe to be joint, an "O" ring of correct size may be pushed over the outside of the transite pipe; then pipe and "O" ring are pushed into the bore/inside of the cast iron pipe.

LEAD AND OAKUM METHOD:

1. Align the pipe, centered inside the hub.
2. Pack the oakum to the standard (about 1" of top) as per procedure.
3. Heat lead.
4. Apply the lead runner to the joint.
5. Pour the lead into the joint.

FLEXIBLE ELASTOMERIC PVC METHOD:

1. When connecting the transite pipe to the spigot or the plain end of the cast iron pipe, a flexible Elastomeric PVC coupling may be used.
2. The plumber should consult a distributor for the proper fitting for specific applications.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.4 continued

TASK: Join dissimilar pipes.

PERFORMANCE GUIDE continued:

3. Align the pipe.
4. Install the elastomeric coupling on the outside of both pipes to be joined.
5. Tighten the clamps with a screwdriver or a socket.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.5

TASK: Use arc welding techniques to join pipes.

STANDARD OF PERFORMANCE OF TASK:

Pipes must be properly aligned, stable and leak free when filled with water under specified pressure.

SOURCE OF STANDARD: Advanced Plumbing, Chapter 5

CONDITIONS FOR PERFORMANCE OF TASK:

Arc welding unit with proper rod
Pipe to be welded
Files to square butt joint

PERFORMANCE GUIDE:

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.6

TASK: Use compressed connections to join tubings.

STANDARD OF PERFORMANCE OF TASK:

Pipes and valve or faucet connections properly aligned, stable and leak free when filled with water.

Faucets should be free of scratches or marks.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5
V-TECS: Plumber

CONDITIONS FOR PERFORMANCE OF TASK:

Pipe to be joined by compression rings
Fitting or faucet to be joined
Standard plumber's tool kit

PERFORMANCE GUIDE:

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.7

TASK: Use gas welding techniques to join pipes.

STANDARD OF PERFORMANCE OF TASK:

Pipes must be properly aligned, stable and leak free when filled with water at appropriate pressure.

Welding joint is vibration proof and stronger than the pipe itself.

SOURCE OF STANDARD: Advanced Plumbing, Chapter 5

CONDITIONS FOR PERFORMANCE OF TASK:

Pipes to be joined by gas welding process
Ox-Acy welding equipment
Standard plumber's tool kit
Appropriate rods

PERFORMANCE GUIDE:

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.8

TASK: Use gaskets to join pipes.

STANDARD OF PERFORMANCE OF TASK:

Pipe and fittings must be properly aligned, stable and leak free when filled with water under appropriate pressure.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5
Mid America Residential Plumber, part 1

CONDITIONS FOR PERFORMANCE OF TASK:

Pipes to be joined by gasket method
Standard plumber's tool kit
Pipe stirrup
Block of wood
Lubricant or glue
Digging bar
Neoprene gasket

PERFORMANCE GUIDE:

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.9

TASK: Use neoprene hub inserts to join pipes.

STANDARD OF PERFORMANCE OF TASK:

Pipes and fittings must be properly aligned, stable and leak free when filled with water under appropriate pressure.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5
Mid America Residential Plumber -- Part I

CONDITIONS FOR PERFORMANCE OF TASK:

Pipes to be joined by hub-insert method
Standard plumber's tool kit
Pipe stirrup
Block of wood
Lubricant or glue
Digging bar
Neoprene hub insert

PERFORMANCE GUIDE:

1. Use full lengths of cast iron pipe or cut to the desired length.
2. Place the neoprene gasket on the end of one pipe and the stainless steel clamp assembly on the end of the other pipe.
3. Firmly seat the pipe ends against the integrally molded shoulder inside the neoprene gasket.
4. Slide the clamp assembly into position over the gasket.
5. Tighten the stainless steel bands alternately and firmly to 60 inch-pounds of torque.
6. Check for proper grade and alignment.
7. Test pipe for leaks with water.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.10

TASK: Use no-hub or band clamp couplings to join pipe.

STANDARD OF PERFORMANCE OF TASK:

Pipes and fittings must be properly aligned, stable and leak free when filled with water under appropriate pressure.

Stainless steel must be torqued to 60 inch pounds.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5
V-TECS: Plumber

CONDITIONS FOR PERFORMANCE OF TASK:

Given no-hub or band clamp pipe to be joined
Standard plumber's tool kit
Band clamp and shield assembly
Gasket
Torque socket wrench

PERFORMANCE GUIDE:

1. Use full lengths of cast iron pipe or cut to the desired length.
2. Place the neoprene gasket on the end of one pipe and the stainless steel clamp assembly on the end of the other pipe.
3. Firmly seat the pipe ends against the integrally molded shoulder inside the neoprene gasket.
4. Slide the clamp assembly into position over the gasket.
5. Tighten the stainless steel bands alternately and firmly to 60 inch-pounds of torque.
6. Check for proper grade and alignment.
7. Test the pipe for leaks with water.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gasetight and watertight seals

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PERFORMANCE OBJECTIVE 5.11

TASK: Identify and explain purpose of screw pipe fittings.

STANDARD OF PERFORMANCE OF TASK:

Pipe and fittings must be properly identified and information from thread tables interpreted with 85% accuracy.

SOURCE OF STANDARD:

CONDITIONS FOR PERFORMANCE OF TASK:

Various types of galvanized steel or black iron pipe
Fittings
Table with threads per inch
Paper and pencil

PERFORMANCE GUIDE:

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.12

TASK: Identify and explain the use of screw pipe cutters.

STANDARD OF PERFORMANCE OF TASK:

Identify and prepare a written explanation for use of a wheel pipe cutter for steel and copper pipe.

Identify and prepare a written explanation for use of a blade type cutter for plastic pipe with 85% accuracy.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5

CONDITIONS FOR PERFORMANCE OF TASK:

Wheel pipe cutter for iron pipe
Wheel pipe cutter for copper pipe
Wheel pipe cutter for plastic pipe
Pencil and paper

PERFORMANCE GUIDE:

A. Cut with hand pipe cutter:

1. Secure the pipe in the vise so that it will not move while cutting.
2. Measure and mark the pipe at the desired length.
3. Open the pipe cutters so that they will easily go over the outside diameter of the pipe.
4. Gently close the jaws of the pipe cutters so that they bring the cutting wheel on to your mark with the rollers properly facing the pipe.
5. Rotate the cutters around the pipe one or two times.
6. Inspect the cut line to assure alignment.

   Note: Any mis-alignment will lead to "tracking" which will make a screw pattern on the pipe and will not give an accurate or usable cut.

7. Tighten the wheel approximately 1/4 turn per revolution of the cutters until a neat, clean cut is made. Over tightening will often cause tracking and damage to the pipe end.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.12 continued

TASK: Identify and explain the use of screw pipe cutters.

PERFORMANCE GUIDE continued

8. Deburr the pipe end both internally and externally with a reaming tools.
9. Inspect the pipe end for a smooth, square cut which is free from internal and external burrs.

B. Cut with power pipe cutter:

1. Set up power vise and tools on a dry, level spot.
2. Measure and mark the pipe at the desired length.
3. Insert the pipe into the jaws of the power vise so that the scribe mark is near the front of the cutting tool. Tighten securely.
4. Gently close the cutting blade on your mark with the rollers properly facing the pipe.
5. "Bump" the power vice switch so that the machine rotates the pipe one or two turns.
6. Inspect the cut line to assure alignment.

   Note: Any mis-alignment will lead to "tracking" which will make a screw pattern on the pipe and will not give an accurate or usable cut.

7. Put a drop or two of oil on the cut line to assist in cutting.
8. Tighten the cutting wheel approximately 1/4 turn per revolution of the cutters until a neat, clean cut is made. Over tightening will often cause tracking and damage the pipe end.
9. Deburr the pipe end both internally and externally with a reaming tool.
10. Inspect pipe end for a smooth, square cut which is free from internal and external burrs.
11. Wipe with a rag.
12. Remove the pipe from the power-vise or prepare to thread as required.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.13

TASK: Identify and explain the use of screw pipe reamers.

STANDARD OF PERFORMANCE OF TASK:

Identify and prepare a written explanation for use of pipe reamers for steel, copper and plastic pipe with 85% accuracy.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5

CONDITIONS FOR PERFORMANCE OF TASK:

Reamer for copper pipe
Inside and outside reamer for plastic pipe
Spiral Reamer for steel pipe
Paper and pencil

PERFORMANCE GUIDE:

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.14

TASK: Identify and explain the use of pipe vise.

STANDARD OF PERFORMANCE OF TASK:

Identify and explain the use of the 6 types of pipe vises with 100% accuracy.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5

CONDITIONS FOR PERFORMANCE OF TASK:

Pipe vise -- jaw type
Pipe vise -- chain type
Paper and pencil

PERFORMANCE GUIDE:

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.15

TASK: Identify and explain the use of hand dies.

STANDARD OF PERFORMANCE OF TASK:

Identify and explain the use of the 6 types of hand pipe dies with 100% accuracy.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5

CONDITIONS FOR PERFORMANCE OF TASK:

Ratchet type hand die for pipe
Non-ratchet type hand die for pipe
Paper and pencil

PERFORMANCE GUIDE:

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.16

TASK: Identify and explain the use of ratchet.

STANDARD OF PERFORMANCE OF TASK:

Identify and explain the use of the ratchet type pipe threader, with 100% accuracy.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5
Basic Plumbing, Unit 4

CONDITIONS FOR PERFORMANCE OF TASK:

Ratchet type pipe threader
Paper and pencil

PERFORMANCE GUIDE:

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.17

TASK: Thread pipe.

STANDARD OF PERFORMANCE OF TASK:

Pipe must have a smooth, even and square cut. All internal and external burrs removed.
Proper thread as to American Standard pipe thread table.
Fitting must turn on to the threads 3 full turns by hand.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5

CONDITIONS FOR PERFORMANCE OF TASK:

Lengths of pipe to be threaded
Standard plumber's tool kit
Pipe threading machine, complete with cutter, reamer and die head.
Thread cutting oil

PERFORMANCE GUIDE:

A. Thread steel pipe:

1. Insert pipe into power vise leaving approximately 4" protruding through front of vise.
2. Tighten jaws of power vise onto pipe.
3. Plug power vise into grounded receptacle.
4. Turn vise on, insert reamer into pipe to remove inside sharp edge, turn off vise.
5. Slide proper size dies over the end of the pipe, turn one turn until dies start then place handle of stocks against brace bar of vise and turn vise on forward.
6. Keep threads well oiled while cutting.
7. When approximately 3 threads protrude through end of dies, turn machine off, slide brace bar back in place and unscrew stocks and dies.
8. Wipe threads clean of oil and pipe shavings.

   Note: Protect floor from dripping oil and pipe shavings.

9. Check that the pipe has the proper number of threads which are clean, free of chips, burrs and tears.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.17 continued

TASK: Thread pipe.

PERFORMANCE GUIDE continued

B.

1. Fasten the pipe securely in vise.
2. Ream the inside of the pipe back to original bore diameter.
3. Slide stock over the end of the pipe with guide on the inside (next to vise).
4. Push die against pipe with heel of one hand.
5. Take 3 or 4 short, slow, clockwise strokes pressing die firmly against the pipe. When enough thread has been cut to start a die on the pipe, apply oil on dies.
6. Continue turning stock with downward strokes on handle, oil often.
7. Periodically check for clean threads.
8. Continue above, until threaded pipe extends flush with die end of stock.
9. To remove threader, turn stock counter clockwise until die is free of cut threads.
10. Wipe threads clean of oil and pipe shavings.

    Note: Protect floor from dripping oil and pipe shavings.

11. Check that threads are clean, free of chips, burrs and tears.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.18

TASK: Place fittings on threaded pipe.

STANDARD OF PERFORMANCE OF TASK:

Fitting should be aligned with pipe and proper amount of pipe dope applied.

SOURCE OF STANDARD: Basic Plumbing, Unit 8

CONDITIONS FOR PERFORMANCE OF TASK:

Fittings and threaded pipe
Pipe vise
Standard plumber's tool kit
Pipe joint compound

PERFORMANCE GUIDE:

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.19

TASK: Tighten fitting using appropriate wrench.

STANDARD OF PERFORMANCE OF TASK:

Fitting must be tight, but not stretched and watertight when submitted to the proper test.

SOURCE OF STANDARD: Basic Plumbing, Unit 8

CONDITIONS FOR PERFORMANCE OF TASK:

Fittings and threaded pipe
Standard plumber's tool kit

PERFORMANCE GUIDE:

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.20

TASK: Identify and explain the use of copper fittings.

STANDARD OF PERFORMANCE OF TASK:

Must be able to identify and properly specify the types of fittings to be used on any specific job, with 85% accuracy.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5
Basic Plumbing, Unit 6

CONDITIONS FOR PERFORMANCE OF TASK:

Various sizes and types of copper fittings
Various sizes and types of cast bronze fittings
Various sizes and types of wrought copper fittings
Paper and pencil

PERFORMANCE GUIDE:

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

---

PERFORMANCE OBJECTIVE 5.21

TASK: Identify and explain the purpose for cutting and reaming copper pipe.

STANDARD OF PERFORMANCE OF TASK:

Identify lengths of pipes needed from plans and explain the procedures for cutting and reaming copper pipe with 85% accuracy.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5

CONDITIONS FOR PERFORMANCE OF TASK:

Paper and pencil
Plans and specifications

PERFORMANCE GUIDE:

A. Cut with tubing cutter:

1. Measure and mark pipe at desired length.
2. Open tubing cutters so that they will easily go over outside diameter of the pipe.
3. Gently close jaws of the tubing cutters so that they bring cutting wheel to mark with rollers properly facing the pipe.
4. Rotate the cutters around the pipe one or two times.
5. Inspect the cut line to assure alignment.

   Note: Any mis-alignment will lead to "tracking" which will make a screw pattern on the pipe and will not give an accurate or usable cut.

6. Tighten the cutting wheel approximately 1/4 turn per revolution of the cutters until a neat, clean cut is made. Over tightening will often cause cracking and damage to the pipe end.
7. Ream the pipe both internally and externally to remove burrs, shoulders, and ragged edges.
8. Inspect tubing and pipe ends for smooth, square cut which is free from internal and external burrs.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.21 continued

TASK: Identify and explain the purpose for cutting and reaming copper pipe.

PERFORMANCE GUIDE continued:

B. Cut with hacksaw:

1. Measure and mark pipe at desired length.
2. Place pipe in miter box or support the pipe so that it will not move while cutting.
3. Begin cutting pipe by pushing the saw away and downward. Do not attempt to force the saw. Cut smoothly.
4. Lift the saw slightly and return to the starting position of the saw.
5. Continue cutting until the pipe has been cut.
6. Ream the pipe both internally and externally to remove burrs, shoulders and ragged edges.
7. If the cut is not square, face it off with a file or saw blade.
8. Wipe away all saw and tile shavings.
9. Inspect the tubing and pipe end for smooth, square cut which is free from internal and external burrs.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

---

PERFORMANCE OBJECTIVE 5.22

TASK: Identify and explain the purpose for flaring, flanging, or swaging copper pipe.

STANDARD OF PERFORMANCE OF TASK:

Explain the purpose for using the types of cold joining of copper pipe.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5

CONDITIONS FOR PERFORMANCE OF TASK:

Paper and pencil
Uniform Plumbing Code

PERFORMANCE GUIDE:

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.23

TASK: Use flaring or swaging tools and fittings.

STANDARD OF PERFORMANCE OF TASK:

Pipe and fittings must be properly aligned and leak free, when submitted to the appropriate test.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5
Uniform Plumbing Code

CONDITIONS FOR PERFORMANCE OF TASK:

Appropriate swagging tools
Standard plumber's tool kit
Appropriate flaring tools
Appropriate copper and plastic pipe

PERFORMANCE GUIDE:

FLARE METHOD:

1. Measure the length of copper tube accurately so that the pipe will fit securely between joints without placing undue stress on the flare joint or length of pipe.
2. Cut the tube to the required length.
3. Ream the tube end so that any burrs or ridges are removed.
4. Slip the coupling nut over the end of the tube.

IMPACT DRIVE METHOD:

1. Insert the proper size flaring tool into the tube end.
2. Drive the flaring tool into the tube end by striking several blows with a hammer.

   Note: This will expand the end of the tube to the desired flare.

3. Assemble the joint by placing the fitting squarely against the flare. Engage the coupling nut with the fitting threads. Tighten with two wrenches, one on the nut and the other on the fitting.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.23 continued

TASK: Use flaring or swaging tools and fittings.

PERFORMANCE GUIDE continued:

SCREW-TYPE FLARE TOOL:

1. Clamp the tube in the flaring block so that the end of the tube is slightly above the face of the block.
2. Place the yoke of the flaring tool on the block so that the beveled end of the compressor cone is over the tube end.
3. Turn the compressor screw down firmly, forming the flare between the chamber in the flaring block and the beveled compressor cone.
4. Remove the flaring tool and assemble the joint.
5. Lubricate sparingly.
6. Tighten with two wrenches.
7. Test pipe for leaks with water.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.24

TASK: Identify and explain the steps of procedures in sweat soldering copper pipe.

STANDARD OF PERFORMANCE OF TASK:

List and explain the steps of procedure for joining copper pipe by the sweat methods.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 12
Mid America Residential Plumber

CONDITIONS FOR PERFORMANCE OF TASK: Paper and pencil

PERFORMANCE GUIDE:

1. Measure the length of copper tube accurately so that the piece of pipe will fit all the way into the socket of the fittings.
2. Cut the tube "square" so that it makes an exact fit into the socket of the fitting.
3. Ream the tube end so that any small burrs or ridges are removed.
4. Clean the outside surface of the tube and the inside of the fitting so that a bright copper results.
5. Flux the surfaces to be joined with an even but thin film of flux with a small brush or clean rag.

   Note: Read the instructions on the container regarding the need to stir or agitate the contents of the flux media.

6. Assemble the joint by inserting the tube into the fitting socket, making sure that the tube is firm against the end of the socket. A small twist will help spread the flux over the two surfaces. Remove the excess flux with a rag.
7. Apply heat to the fitting and move the heat around the fitting for even distribution. Avoid overheating which will burn the flux and destroy its effectiveness.
8. Feed solder at the joint between the tube and the fitting.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.24 continued

TASK: Identify and explain the steps of procedures in sweat soldering copper pipe.

PERFORMANCE GUIDE continued:

9. When the joint is hot enough, the solder will melt on contact with the tube and the flame should be moved away.

   Note: Capillary action will draw free flowing molten solder into the narrow clearance between the fitting and the tube.

10. Allow the joint to cool naturally.
11. Wipe off excess flux.
12. Test the pipes for leaks with water.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.25

TASK: Identify and explain the use of plastic pipe fittings.

STANDARD OF PERFORMANCE OF TASK:

Identify and state purpose for using plastic pipe fittings with 85% accuracy.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5

CONDITIONS FOR PERFORMANCE OF TASK:

Paper and pencil
Various plastic pipe fittings to be identified
Local Plumbing code

PERFORMANCE GUIDE:

1. Organize work area, materials, and tools to achieve proficiency and speed.
2. Cut pipe to desired length.
3. Clean and dry all parts before assembly.
4. Apply primer to the pipe end and to the fitting socket.
5. Immediately apply a smooth coat of cement covering the entire surface of the fitting socket.
6. Apply a coat of cement to the pipe surface for the total length of the depth of the socket.
7. Immediately insert the pipe into the fitting socket.
8. Turn the pipe 1/8 to 1/4 turn in the socket to assure an even spread of cement.
9. Hold firmly for 15 to 30 seconds to prevent movement of the pipe in the fitting.
10. Close all lids when not in use.
11. Test and recheck pipe for leaks with water.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.26

TASK: Identify and explain the use of rigid plastic pipe and fittings.

STANDARD OF PERFORMANCE OF TASK:

Identify samples of the three types of pipe and fittings with 85% accuracy.

List the uses of the three types of pipe and fittings for local plumbing installations according to local plumbing codes with 100% accuracy.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5
Local plumbing code

CONDITIONS FOR PERFORMANCE OF TASK:

Paper and pencil
ABS, PVC and CPVC pipe and fittings
Local plumbing code

PERFORMANCE GUIDE:

1. Organize work area, materials, and tools to achieve proficiency and speed.
2. Cut pipe to desired length.
3. Clean and dry all parts before assembly.
4. Apply primer to the pipe end and to the fitting socket.
5. Immediately apply a smooth coat of cement covering the entire surface of the fitting socket.
6. Apply a coat of cement to the pipe surface for the total length of the depth of the socket.
7. Immediately insert the pipe into the fitting socket.
8. Turn the pipe 1/8 to 1/4 turn in the socket to assure an even spread of cement.
9. Hold firmly for 15 to 30 seconds to prevent movement of the pipe in the fitting.
10. Close all lids when not in use.
11. Test and recheck pipe for leaks with water.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.27

TASK: Identify and explain the use of semi-rigid plastic pipe and fittings.

STANDARD OF PERFORMANCE OF TASK:

Identify and explain the use of various types of semi-rigid pipe and fittings with 85% accuracy.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5
Local plumbing code

CONDITIONS FOR PERFORMANCE OF TASK:

Paper and pencil
Flexible plastic tubing and fitting
Local plumbing code

PERFORMANCE GUIDE:

1. Organize work area, materials, and tools to achieve proficiency and speed.
2. Cut pipe to desired length.
3. Clean and dry all parts before assembly.
4. Apply primer to the pipe end and to the fitting socket.
5. Immediately apply a smooth coat of cement covering the entire surface of the fitting socket.
6. Apply a coat of cement to the pipe surface for the total length of the depth of the socket.
7. Immediately insert the pipe into the fitting socket.
8. Turn the pipe 1/8 to 1/4 turn in the socket to assure an even spread of cement.
9. Hold firmly for 15 to 30 seconds to prevent movement of the pipe in the fitting.
10. Close all lids when not in use.
11. Test and recheck pipe for leaks with water.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.28

TASK: Measuring and marking plastic pipe.

STANDARD OF PERFORMANCE OF TASK:

Accuracy of measurements must be within 1/16". Mark must clearly indicate exactly the length of material.

SOURCE OF STANDARD:

Mid America Residential Plumber, Part 1

CONDITIONS FOR PERFORMANCE OF TASK:

Appropriate measuring tools
Appropriate marking tools
ABS, PVC, CPVC pipes of various lengths

PERFORMANCE GUIDE:

1. Organize work area, materials, and tools to achieve proficiency and speed.
2. Cut pipe to desired length.
3. Clean and dry all parts before assembly.
4. Apply primer to the pipe end and to the fitting socket.
5. Immediately apply a smooth coat of cement covering the entire surface of the fitting socket.
6. Apply a coat of cement to the pipe surface for the total length of the depth of the socket.
7. Immediately insert the pipe into the fitting socket.
8. Turn the pipe 1/8 to 1/4 turn in the socket to assure an even spread of cement.
9. Hold firmly for 15 to 30 seconds to prevent movement of the pipe in the fitting.
10. Close all lids when not in use.
11. Test and recheck pipe for leaks with water.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.29

TASK: Cutting plastic pipe.

STANDARD OF PERFORMANCE OF TASK:

Accuracy of cut must be within 1/16" of marked length, square and inside and outside burrs removed.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 4
Mid America Residential Plumber, Part 1

CONDITIONS FOR PERFORMANCE OF TASK:

Miter box and back saw
Blade type wheel pipe cutter

PERFORMANCE GUIDE:

A. Cut with hand saw:

1. Measure and mark the pipe at the desired length.
2. Place the pipe in the miter box or support the pipe so that it will not move while cutting.
3. Begin cutting the pipe by pushing the saw away and downward. Do not attempt to force the saw. Cut smoothly.
4. Lift the saw slightly and return to the starting position of the saw.
5. Continue cutting until the blade cuts through the pipe.
6. Ream the pipe both internally and externally to remove burrs, shoulders and ragged edges.
7. If the cut is not square, face it off with a rasp or saw blade.
8. Wipe away all saw and pipe shavings.
9. Inspect the pipe end for a smooth, square cut which is free from internal and external burrs.

B. Cut with tubing cutter:

1. Measure and mark the pipe at the desired length.
2. Open the cutters so that they will easily go over the outside diameter of the pipe.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.29 continued

TASK: Cutting plastic pipe.

PERFORMANCE GUIDE continued:

B. Cut with tubing cutter (continued):

3. Squeeze the handles of the cutters so that they bring the cutting blade on to the mark with the rollers properly facing the pipe.
4. Inspect the cut line to assure alignment.

   Note: Any mis-alignment will lead to "tracking" which will make a screwpattern on the pipe and will not give an accurate or usable cut.

5. Deburr the pipe end both internally and externally with a reaming tool.
6. Inspect the pipe end for a smooth square cut which is free from internal and external burrs.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.30

TASK: Identify and explain the purpose of steel clamps.

STANDARD OF PERFORMANCE OF TASK:

Identify and explain the purpose of stainless steel clamps and plastic inserts with 85% accuracy.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5
Local plumbing code

CONDITIONS FOR PERFORMANCE OF TASK:

Paper and pencil
Local plumbing code
Samples of stainless steel clamps and fittings

PERFORMANCE GUIDE:

USE CLAMP METHOD:

1. Mark and cut the tubing with scissors cutter.
2. Insert fitting into the tubing.
3. Place crimp clamp on the tubing.
4. Insert fitting into the tubing.
5. Place clamp in the proper position.
6. Clamp tubing in place.
7. Test pipe for leaks with water.

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

---

PERFORMANCE OBJECTIVE 5.31

TASK: Use steel clamps to joint semi-rigid pipe.

STANDARD OF PERFORMANCE OF TASK:

Pipes must be properly aligned, clamps must be securely fastened, lead free when submitted to proper pressure test.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5
Local Plumbing code

CONDITIONS FOR PERFORMANCE OF TASK:

Screwdriver
P.E. pipe and insert fittings
Stainless steel clamps

PERFORMANCE GUIDE:

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.32

TASK: Identify and explain the use of plastic pipe solvent.

STANDARD OF PERFORMANCE OF TASK:

List and explain use of the various plastic pipe solvents with 85% accuracy.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5
Mid America Residential Plumber, Part 1

CONDITIONS FOR PERFORMANCE OF TASK:

Paper and pencil
Local plumbing code
Appropriate primers and solvents

PERFORMANCE GUIDE:

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

---

PERFORMANCE OBJECTIVE 5.33

TASK: Use plastic pipe solvent to joint pipe and fittings.

STANDARD OF PERFORMANCE OF TASK:

Pipes must be properly aligned, with proper bead of cement, observable at all edges of the connection.

Unit must be leak free when submitted to appropriate test. Allow 24 hours before testing.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5
Mid America Residential Plumber, Part 1

CONDITIONS FOR PERFORMANCE OF TASK:

Appropriate primers and solvents
Various types of plastic pipe
Standard plumber's tool kit

PERFORMANCE GUIDE:

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

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PERFORMANCE OBJECTIVE 5.34

TASK: Measuring cast-iron soil pipe.

STANDARD OF PERFORMANCE OF TASK:

Measurement must be accurate within +- 1/8".

Mark must clearly indicate length to be cut.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 5

CONDITIONS FOR PERFORMANCE OF TASK:

Flexible steel tape
Soapstone
Scribe
Length of cast iron soil pipe

PERFORMANCE GUIDE:

COMPETENCY: 5 Demonstrate cutting, threading, and assembling pipe to insure gastight and watertight seals

---

PERFORMANCE OBJECTIVE 5.35

TASK: Cutting cast-iron soil pipe.

STANDARD OF PERFORMANCE OF TASK:

Pipe must be free from cracks, and cut must be smooth even and square.

SOURCE OF STANDARD: Plumbing Installation and Design -- Chapter 5

CONDITIONS FOR PERFORMANCE OF TASK:

Length of cast iron soil pipe
Snap-type chain cutter

PERFORMANCE GUIDE:

A. Cut with snap-type chain cutter:

1. Measure and mark the length of pipe to be cut.
2. Position the chain of the snap cutter around pipe so that a minimum number of wheels are in contact with the pipe. This will help produce a square cut.
3. Tighten tool's pressure on the pipe, then apply a quick final pressure to complete the cut.
4. Inspect pipe for smooth, even, square cut.
5. Inspect pipe for cracks.
6. Prepare tools for the next cut.

B. Cut with hammer and chisel:

1. Draw a chalk mark around the entire circumference of the pipe where the cut is to be made.
2. Lay the pipe over the 2" X 4" board, or use a mound of earth to support the pipe while it is turned.
3. Score the pipe barrel around the chalk mark with the cold chisel. Tapping lightly with hammer, turn the pipe until it has been evenly scored all around.
4. Continue to turn the pipe and strike the chisel with increasingly heavy blows until the pipe breaks off (evenly) at the line of cut.
5. Inspect the pipe for a smooth, even and square cut.

COMPETENCY: 6 Apply local plumbing code and regulations needed to pass inspection

---

PERFORMANCE OBJECTIVE 6.1

TASK: Acquire necessary licenses.

STANDARD OF PERFORMANCE OF TASK:

Plumbers license is acquired where needed.
Contractors C-37 (Arizona) license is acquired.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Qualifying experience
Sufficient money to pay costs
Application forms from agenices

PERFORMANCE GUIDE:

COMPETENCY: 6 Apply local plumbing code and regulations needed to pass inspection

---

PERFORMANCE OBJECTIVE 6.2

TASK: Determine application to installations.

STANDARD OF PERFORMANCE OF TASK:

Identifies relevant provision of local code applicable to a given installation.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Copy of local plumbing code
Given installation

PERFORMANCE GUIDE:

COMPETENCY: 6 Apply local plumbing code and regulations needed to pass inspection

---

PERFORMANCE OBJECTIVE 6.3

TASK: Determine pipe sizes, gauges, and pitches.

STANDARD OF PERFORMANCE OF TASK:

Correctly identifies a given pipe as to size, gauge and pitch.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Pipes of various sizes, gauges and pitches

PERFORMANCE GUIDE:

COMPETENCY: 6 Apply local plumbing code and regulations needed to pass inspection

---

PERFORMANCE OBJECTIVE 6.4

TASK: Define symbols used in plumbing drawings.

STANDARD OF PERFORMANCE OF TASK:

Defines symbols on a plumbing drawing to an accuracy of 85% without any key or look-up resource.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Plumbing drawings with industry standard symbols

PERFORMANCE GUIDE:

COMPETENCY: 6 Apply local plumbing code and regulations needed to pass inspection

---

PERFORMANCE OBJECTIVE 6.5

TASK: Define terms used in local plumbing codes.

STANDARD OF PERFORMANCE OF TASK:

Defines terms used in local plumbing code with 85% accuracy.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Glossary from local building codes

PERFORMANCE GUIDE:

COMPETENCY: 6 Apply local plumbing code and regulations needed to pass inspection

---

PERFORMANCE OBJECTIVE 6.6

TASK: Select fittings, fixtures, and pitches.

STANDARD OF PERFORMANCE OF TASK:

Selects fittings, fixtures and pitches appropriate for given situation.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Given situation requiring selection of fittings, fixtures and pitches.

PERFORMANCE GUIDE:

COMPETENCY: 6 Apply local plumbing code and regulations needed to pass inspection

---

PERFORMANCE OBJECTIVE 6.7

TASK: Demonstrate use of index in the local plumbing code.

STANDARD OF PERFORMANCE OF TASK:

Successfully locates needed information in local code book within 3 minutes.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Local plumbing code
Given code topic for which information is needed

PERFORMANCE GUIDE:

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

---

PERFORMANCE OBJECTIVE 7.1

TASK: Connecting building sewers to main.

STANDARD OF PERFORMANCE OF TASK:

Maintain a minimum -- 2% grade from building to inlet.

Connection must be leak free.

Installation shall meet governing codes and specifications.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Connecting hub
Standard plumber's tool kit
Excavation equipment
Pipes
Engineers level
Pick, shovel

PERFORMANCE GUIDE:

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

---

PERFORMANCE OBJECTIVE 7.2

TASK: Install septic tanks and lines.

STANDARD OF PERFORMANCE OF TASK:

Tank must be level and water tight.

Tank must be properly backfilled to avoid floating or tilting due to ground water.

Maintain a minimum 2% grade from building sewer to inlet side of tank or deep enough to receive effluent from the building it serves.

Installation shall meet governing codes and specifications.

SOURCE OF STANDARD: V-TEC: Plumber, 1984

CONDITIONS FOR PERFORMANCE OF TASK:

Septic tank
Location for installation
Excavation equipment
Tools for joining type of pipe
Appropriate joint sealer
Leech piping
Engineer's level
Pick, shovel

PERFORMANCE GUIDE:

1. Determine the depth of hole by invert elevation of proposed or existing building sewer.
2. Maintain a minimum 2% grade from building sewer to inlet side of tank or deep enough to receive effluent from the building it serves (adequate grade).
3. Excavate for required depth for spetic tank. If ground water is a problem, an artificial foundation may be required for tank.
4. Have tank delivered and set in place.
5. Set tank level.
6. Invert of discharge will be two inches lower than invert of inlet pipe.

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

---

PERFORMANCE OBJECTIVE 7.2 continued

TASK: Install septic tanks and lines.

PERFORMANCE GUIDE continued:

7. To prevent floating solid from entering incoming or discharge pipes, place tees with short pipes extending down into effluent on inlet and discharge inside of septic tank.

   Note: In lieu of tees, approved baffles may be used. When inlet and discharge pipes enter tank a water-tight connection may be made by using oakum first and sand and cement mix to fill space between pipes and sides of holes in spetic tank. Tank must be properly backfilled because ground water or rain water in hole may cause tank to float or tilt.

8. Points of penetration shall be made watertight.
9. Back fill around tank to prevent tilting or floating from rain.
10. Check that tank is level, watertight, and meets all pertinent local codes.

    IMPORTANT: Plumber should be aware that local health department or plumbing authority will have strict requirements regarding tank construction, location in respect to buildings and any part of water supply system.

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

---

PERFORMANCE OBJECTIVE 7.3

TASK: Bed lines.

STANDARD OF PERFORMANCE OF TASK:

Hand fill trench to a depth of 12" over top of pipe or two feet of cover for clay pipe.

Caution should be taken to protect pipe from movement or breakage.

Installations shall meet governing codes and specifications.

SOURCE OF STANDARD: V-TEC: Plumbing, 1984

CONDITIONS FOR PERFORMANCE OF TASK:

Bedding material (i.e., sand, fine cinders)
Shovel
Piping system in place

PERFORMANCE GUIDE:

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

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PERFORMANCE OBJECTIVE 7.4

TASK: Backfill and compact excavations.

STANDARD OF PERFORMANCE OF TASK:

Ditch is solidly filled and slightly mounded.

Fill material should be granular soil, free of large rocks, broken concrete or frozen clods. Material should be placed in such a manner as to avoid damage to pipes.

Fill material should be placed in lifts as per specifications.

Installation shall meet governing codes and specifications.

SOURCE OF STANDARD: V-TEC: Plumber 1984

CONDITIONS FOR PERFORMANCE OF TASK:

Pipe in place
Shovel and/or tractor
Tamper

PERFORMANCE GUIDE:

1. Hand fill trench to a depth of 12" over top of pipe (two feet of cover for clay pipe). Caution should be taken to protect pipe from movement or breakage.
2. Fill trench with granular soil without large rocks, broken concrete, or frozen clods of dirt.
3. Remove any shoring material from trench.
4. After pipe is covered, backfill may be placed in trench in six or twelve inch layers compacting each layer until the trench is filled to a desired grade.
5. Check to see that ditch is solidly filled and slightly mounded.

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

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PERFORMANCE OBJECTIVE 7.5

TASK: Calculate pitch required for lines.

STANDARD OF PERFORMANCE OF TASK:

Finished sewer has proper grade from building to sewer connection.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Proposed building sewer line
Builder's level
Tape or ruler

PERFORMANCE GUIDE:

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

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PERFORMANCE OBJECTIVE 7.6

TASK: Determine rough in measurements.

STANDARD OF PERFORMANCE OF TASK:

Dimensions to be determined within +- 1/16".

SOURCE OF STANDARD: Writing team

Manufacturer's specifications

CONDITIONS FOR PERFORMANCE OF TASK:

Blueprint and specifications
Manufacturer's rough-in specifications
Uniform Plumbing Code
Paper and pencil

PERFORMANCE GUIDE:

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

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PERFORMANCE OBJECTIVE 7.7

TASK: Establish finish floor levels.

STANDARD OF PERFORMANCE OF TASK:

Elevations shall be transfered from the bench mark or other existing elevations to grade stakes within an accuracy of +- 1/8".

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Builders level
Bench mark
Plans and specifications
Elevation rod
Staking or other items to indicate floor level adjacent to plumbing systems

PERFORMANCE GUIDE:

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

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PERFORMANCE OBJECTIVE 7.8

TASK: Establish grade lines.

STANDARD OF PERFORMANCE OF TASK:

Line to be maintained within +- 1/8" of finish floor level.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Builders level
Elevation rod
Wood or metal stakes
Bench mark
String line

PERFORMANCE GUIDE:

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COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

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PERFORMANCE OBJECTIVE 7.9

TASK: Install building drains.

STANDARD OF PERFORMANCE OF TASK:

Pipe to be installed at a slope of 1/4" per foot.

Pipes must be aligned, secure, and withstand required test.

Installations shall meet governing codes and specifications.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Standard plumber's tool kit
Plans and specifications
Prepared excavation
Appropriate tools for pipe chosen
Piping and connections (i.e., plastic, cast iron)

PERFORMANCE GUIDE:

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COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

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PERFORMANCE OBJECTIVE 7.10

TASK: Install cleanouts.

STANDARD OF PERFORMANCE OF TASK:

Stack base cleanouts should be located at least 6" above the floor.

Cleanouts must be accessible and protected when used on buried lines, during back filling.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Standard plumber's tool kit
Appropriate plumbing materials
Plans and specifications
Local plumbing code

PERFORMANCE GUIDE:

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

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PERFORMANCE OBJECTIVE 7.11

TASK: Install building sewers.

STANDARD OF PERFORMANCE OF TASK:

Pipe to be installed at a slope of 1/4" per foot.

Pipes must be aligned, secure, and withstand required test.

Installations shall meet governing codes and specifications.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Standard plumber's tool kit
Prepared excavation
Appropriate tools for pipe chosen
Piping and connections (i.e., plastic, cast iron)
Plans and specifications

PERFORMANCE GUIDE:

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

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PERFORMANCE OBJECTIVE 7.12

TASK: Install connection to storm sewers.

STANDARD OF PERFORMANCE OF TASK:

Connection must be water tight using type and size of fitting required by storm sewer system and governing specifications and codes.

SOURCE OF STANDARD: Writing team

Plumbing Installation and Design, 1978, p. 146-152 (Ripka)

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Existing municipal (or other) storm sewers
Standard plumber's tool kit
Storm drain components as specified

PERFORMANCE GUIDE:

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

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PERFORMANCE OBJECTIVE 7.13

TASK: Install field laterals.

STANDARD OF PERFORMANCE OF TASK:

Leech filed pipe to be installed level to 1/4" per foot. Installations shall meet governing codes and specifications.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Leech pipe with connectors
Standard plumber's tool kit
Large aggregate
Straw
Prepared excavation
Appropriate tools for type of pipe cleaner

PERFORMANCE GUIDE:

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

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PERFORMANCE OBJECTIVE 7.14

TASK: Install float valves on water cooling towers.

STANDARD OF PERFORMANCE OF TASK:

Float valve must be installed so as to operate properly; be fastened securely and pass an appropriate water test.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Given water cooler to receive values
Standard plumber's tool kit
Manufacturer's specifications
Appropriate float values

PERFORMANCE GUIDE:

COMPETENCY: 7 Install soil, water, and vent systems within local code requirements.

PERFORMANCE OBJECTIVE 7.15

TASK: Install pipe supports.

STANDARD OF PERFORMANCE OF TASK:

Horizontal pipe must be properly hung with hangers according to local plumbing code.

Vertical pipe must be properly supported and aligned according to local plumbing code.

SOURCE OF STANDARD: Basic Plumbing -- Unit 28
V-TEC: Plumber, 1984

CONDITIONS FOR PERFORMANCE OF TASK:

Horizontal and vertical lines of pipe to be secured
Standard plumber's tool kit
Local plumbing code
Power drill and drill bits
Appropriate hanger and strap

PERFORMANCE GUIDE:

SECURE HORIZONTAL & VERTICAL PIPE:

1. Determine location of hole.
2. Mark hole with star drill and hammer (use glasses for flying chips).
3. Drill hole.
4. Insert plastic plug, tap with hammer until plug is even with wall surface.
5. Determine length of strap metal needed and cut with tin snips.
6. Using #14 1-1/2 in. screws, secure metal to plastic anchor through holes in strap metal.
7. Make sure screws are tight.
8. Check for proper alignment, height, and location of pipe.

FOR HORIZONTAL USING A HANGER:

1. Mark and drill anchor holes.
2. Insert expandable shields/anchors.
3. Attach hanger to anchor/shields.
4. Slip pipe through hanger.

COMPETENCY: 7 Install soil, water, and vent systems within local code requirements.

PERFORMANCE OBJECTIVE 7.15 continued

TASK: Install pipe supports.

PERFORMANCE GUIDE continued

5. Adjust for proper height.
6. Check for proper alignment, height, and location of the pipe.

FOR VERTICAL USING A 2-HOLE PIPE STRAP:

1. Mark and drill anchor holes.
2. Put pipe in place.
3. Slip strap over pipe.
4. Bolt in place.
5. Check for proper height, alignment, and location of pipe.

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

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PERFORMANCE OBJECTIVE 7.16

TASK: Install roof drainage systems.

STANDARD OF PERFORMANCE OF TASK:

Pipe must be aligned, properly supported and leak free when filled with water.

Sizing of vertical rainwater leakers and horizontal storm drains according to tables in local plumbing code.

SOURCE OF STANDARD:

Plumbing Installation and Design, Chapter 6
Local plumbing code

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Standard plumber's tool kit
Appropriate materials for downspouts
Roof drain bodies
Appropriate piping and fittings to install system

PERFORMANCE GUIDE:

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

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PERFORMANCE OBJECTIVE 7.17

TASK: Install soil or waste stacks and vents.

STANDARD OF PERFORMANCE OF TASK:

Pipes to be properly aligned, and securely fastened.

Joints to be leak proof and water tight when appropriate test is applied.

Vents to be properly flashed to roofing materials, and at specified height above roof surface.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Standard plumber's tool kit
Appropriate plumbing materials
Local plumbing codes

PERFORMANCE GUIDE:

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

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PERFORMANCE OBJECTIVE 7.18

TASK: Install storm drains.

STANDARD OF PERFORMANCE OF TASK:

Rainwater leaders and roof drains are properly sized and connected to municipal storm drain (if appropriate).

Horizontal storm drains are graded at least 1/4" per foot.

Installations comply with requirements of governing specifications and codes.

SOURCE OF STANDARD: Writing team

Plumbing Installation and Design, 1978, p. 146-152 (Ripka)

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Standard plumber's tool kit
Storm drains components as per plans and specifications

PERFORMANCE GUIDE:

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

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PERFORMANCE OBJECTIVE 7.19

TASK: Install vent terminals.

STANDARD OF PERFORMANCE OF TASK:

Vent terminal (roof flashing) is nailed down tight and well sealed.

SOURCE OF STANDARD: Writing team
V-TECS: Plumber, 1981, p. 56.

CONDITIONS FOR PERFORMANCE OF TASK:

Given roof that needs vent terminals, vent pipe installed
Standard plumber's tool kit
Utility knife, hammer, roofing nails, roofing cement, putty knife/applicator
Ladder and safety line
Roof flashing with neoprene collar

PERFORMANCE GUIDE:

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

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PERFORMANCE OBJECTIVE 7.20

TASK: Make water test on building drains.

STANDARD OF PERFORMANCE OF TASK:

Water has no less than a 10 ft. head; no more than 5 floors of height in highest vent piping to provide pressure.

Water removed from system when test is completed.

Testing complies with governing specifications and code.

SOURCE OF STANDARD:

Plumbing Installation and Design, 1978, p. 248-250 (Ripka)

CONDITIONS FOR PERFORMANCE OF TASK:

Completed roughed in building drain system
Materials to close all but highest opening in system
Source of water

PERFORMANCE GUIDE:

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

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PERFORMANCE OBJECTIVE 7.21

TASK: Prepare excavations.

STANDARD OF PERFORMANCE OF TASK:

Measured and marked excavation for intersects, per plans and specifications.

Checked proper grade line from building to sewer connection, per plans and specifications.

Excavation free of debris and foreign matter.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Previously dug excavations
Standard plumber's tool kit
Tools and equipment to prepare excavation

PERFORMANCE GUIDE:

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

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PERFORMANCE OBJECTIVE 7.22

TASK: Prepare tripods and transit levels.

STANDARD OF PERFORMANCE OF TASK:

Tripod should be placed securely at the height of the operators eyeline. Do not overtighten transit base to tripod, or adjustment screws on the transit. Transit must maintain its level setting when rotated within the 360o.

SOURCE OF STANDARD: Writing team

Cabinet making and Millwork, Unit 17

CONDITIONS FOR PERFORMANCE OF TASK:

Transit level with tripod

PERFORMANCE GUIDE:

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

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PERFORMANCE OBJECTIVE 7.23

TASK: Shore excavations.

STANDARD OF PERFORMANCE OF TASK:

Excavation shored per OSHA or local authority, whichever takes precedent.

Shoring materials securely fastened to last until removed for excavation back fill.

SOURCE OF STANDARD: Writing team
OSHA

CONDITIONS FOR PERFORMANCE OF TASK:

Excavation previously prepared
Standard plumber's tool kit
Shoring materials
Tools and equipment to shore excavation

PERFORMANCE GUIDE:

COMPETENCY: 7 Install soil, waste, and vent systems within local code requirements

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PERFORMANCE OBJECTIVE 7.24

TASK: Build thrust blocks.

STANDARD OF PERFORMANCE OF TASK:

Thrust blocks placed per plans and specifications.

Installation complies with governing specifications and codes.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Excavation prepared and building drain line laid
Standard plumber's tool kit
Thrust block building materials
Tools and equipment to accomplish plans and specifications

PERFORMANCE GUIDE:

COMPETENCY: 8 Install a water distribution line to meet local plumbing code

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PERFORMANCE OBJECTIVE 8.1

TASK: Use manufacturer's directions to determine fixture, equipment, and water supply location.

STANDARD OF PERFORMANCE OF TASK:

Used plans to locate water supply, and specifications for fixtures and equipment.

Choice complies with governing specifications and codes.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Manufacturer's specifications and instructions

PERFORMANCE GUIDE:

1. Determine fixture manufacturer from contract documents.
2. Use manufacturer's directions to determine fixture, equipment, and water supply locations.
3. Layout should be made so that it does not interfere with basic building structure.

LOCATE ROUGH-IN HOLES:

1. Consult building plans for exact locations of plumbing fixtures and other mechanical materials which will be in the plumbing path.
2. Consult "rough-in" books and/or manufacturer's specifications for waste and water supply dimensions.
3. Draw visual isometric plumbing diagram if one is not available.
4. Mark holes for horizontal pipe runs.

   Note: For waste pipe 1/4" fall per foot grade is required, mark holes accordingly.

COMPETENCY: 8 Install a water distribution line to meet local plumbing code

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PERFORMANCE OBJECTIVE 8.1 continued

TASK: Use manufacturer's directions to determine fixture, equipment, and water supply location.

PERFORMANCE GUIDE continued:

5. Determine the center of the hole.
6. Lay fitting over center of hole and mark the outside of the fitting.
7. Use a plumb bob for locating the holes for vertical pipes.
8. Hang the plumb bob from ceiling or underside of roof moving bob until it is over center of fitting or hole to be extended.
9. After marking the exact location, hammer a long nail up through the floor or roof so that it is visible from the top side of the floor or roof.
10. Mark holes for water pipes so that crossing over waste pipes in walls or other tight locations will not be necessary.

COMPETENCY: 8 Install a water distribution line to meet local plumbing code

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PERFORMANCE OBJECTIVE 8.2

TASK: Select correct pipe sizes, materials, and gauges for specific areas of installations.

STANDARD OF PERFORMANCE OF TASK:

Selected correct pipe sizes, gauges and materials per plans and specifications and work order.

Installation complies with governing specifications and codes.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Standard plumber's tool kit
Structure to receive installation
Installation/plumbing materials
Work order

PERFORMANCE GUIDE:

1. Secure an accurate plumbing schematic for the job at hand.
2. Prepare a list of materials, correct fittings and sizes, equipment, and gauges shown on schematic.

COMPETENCY: 8 Install a water distribution line to meet local plumbing code

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PERFORMANCE OBJECTIVE 8.3

TASK: Rough-in water supply lines.

STANDARD OF PERFORMANCE OF TASK:

Lines correct size and type per plans and specifications.

Branch lines roughed-in with minimum waste and most feasible route.

Supply lines comply with governing specifications and codes.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Standard plumber's tool kit
Structure to receive supply lines
Installation/plumbing materials

COMPETENCY: 8 Install a water distribution line to meet local plumbing code

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PERFORMANCE OBJECTIVE 8.4

TASK: Provide access to lines.

STANDARD OF PERFORMANCE OF TASK:

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Lines that must be serviced
Plans and specifications
Standard plumber's tool kit
Work order

PERFORMANCE GUIDE:

1. Determine from plumbing schematic and Uniform Plumbing Codes, areas that need to have access provided.
2. Construct or install access panels to provide necessary work area.
3. Test location and size of access panels so as to determine their usability.

COMPETENCY: 8 Install a water distribution line to meet local plumbing code

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PERFORMANCE OBJECTIVE 8.5

TASK: Install pipe sleeves or thimbles through walls, ceilings, and floors.

STANDARD OF PERFORMANCE OF TASK:

Hole right size and in proper location per plans and specifications.

Installed pipe clean and filled smooth.

SOURCE OF STANDARD: V-TECS: Plumbing, 1984, p. 34

CONDITIONS FOR PERFORMANCE OF TASK:

Standard plumber's tool kit
Plans and specifications
Structure for water distribution system
Installation/plumbing materials
Proper attire/equipment

PERFORMANCE GUIDE:

1. Secure plans and specifications and perform layout of pipe sleeves and thimbles.
2. Read plans and specifications to determine size of chases needed.
3. Install sleeves and thimbles so as to provide proper access for later installation of pipes and vents.

Install pipe through masonry, concrete:

1. Mark a spot for the hole to be drilled in mortared joint.
2. Start drilling star bit through concrete turning drill approximately 1/8 turn after each stroke of the hammer until hole is through.
3. Insert pipe into the hole.
4. Point up around hole with sakrete.
5. Smooth sakrete into position and clean pipe.
6. Check for proper location of hole and check that pipe is clean with smooth cement around pipe.

COMPETENCY: 8 Install a water distribution line to meet local plumbing code

---

PERFORMANCE OBJECTIVE 8.6

TASK: Install expansion joints.

STANDARD OF PERFORMANCE OF TASK:

Expansion joint is installed in correct location as per plans and specifications.

No leaks exist at connection or M joint device.

Installation meets requirements of governing specifications and codes.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Standard plumber's tool kit
Piping
Expansion joint

PERFORMANCE GUIDE:

1. Select proper tools for task.
2. Locate expansion joints from plumbing layout.
3. Install joints with proper method of joining according to piping material specified.

COMPETENCY: 8 Install a water distribution line to meet local plumbing code

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PERFORMANCE OBJECTIVE 8.7

TASK: Install pumps.

STANDARD OF PERFORMANCE OF TASK:

Pump moves water in intended direction at proper velocity and pressure.

Pump turns on and shuts off at prescribed pressures.

Pump operates without excessive vibration and is securely mounted.

Pump installation complies with requirements of governing specifications and codes.

SOURCE OF STANDARD: Writing team

Mid America -- Residential Plumbing, Unit P-5

CONDITIONS FOR PERFORMANCE OF TASK:

Manufacturer's specifications and instructions
Standard plumber's tool kit
Appropriate fittings and piping
Appropriate mounting site and devices if applicable

PERFORMANCE GUIDE:

1. Read prints and specifications to determine location and intended purpose of pump to be installed.
2. Select and equip jobsite with proper tools.
3. Install pump with joining method determined by the type of piping material used.
4. Test for leaks.

COMPETENCY: 8 Install a water distribution line to meet local plumbing code

---

PERFORMANCE OBJECTIVE 8.8

TASK: Install clamps to support pipes.

STANDARD OF PERFORMANCE OF TASK:

Pipe must be securely supported, aligned, cut the proper length, and placed in the proper location.

Installation must comply with governing specifications and codes.

SOURCE OF STANDARD: V-TECS: Plumber, 1984, p. 39-45

CONDITIONS FOR PERFORMANCE OF TASK:

Work order
Standard plumber's tool kit
Piping system
Appropriate size and style of clamps

PERFORMANCE GUIDE:

1. Select proper tools for task.
2. Use type and quantity of clamps specified by local codes and working drawings.
3. Install clamps in an orderly workmanlike manner.

COMPETENCY: 8 Install a water distribution line to meet local plumbing code

---

PERFORMANCE OBJECTIVE 8.9

TASK: Install cold water storage tanks.

STANDARD OF PERFORMANCE OF TASK:

Task complete within two hours.
No leaks in installation.
Tank secured or mounted as specified.
All connections at prescribed points.
Installation complies with governing specification and code.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Manufacturer's specifications and instruction
Standard plumber's tool kit
Cold water storage tank
Appropriate fittings and supplies
Valves and connections as specified

PERFORMANCE GUIDE:

1. Read plans and specifications to identify method of installation.
2. Select proper tools and supply them to jobsite.
3. Mount tank securely per manufacturer's specifications.
4. Make all connection as specified.
5. Test for leaks.

COMPETENCY: 8 Install a water distribution line to meet local plumbing code

---

PERFORMANCE OBJECTIVE 8.10

TASK: Install cut off valves.

STANDARD OF PERFORMANCE OF TASK:

Cut-off valve installed at proper location per plans and specifications.

Complies with governing specifications and codes.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Standard plumber's tool kit
Cut-off valve
Water distribution system
Installation/plumbing materials

PERFORMANCE GUIDE:

1. Read plans and specifications to identify proper valve.
2. Equip jobsite with proper tools.
3. Install valves using the joining method prescribed for the type of piping materials.
4. Test installation for leaks.

COMPETENCY: 8 Install a water distribution line to meet local plumbing code

---

PERFORMANCE OBJECTIVE 8.11

TASK: Install hangers to support pipe.

STANDARD OF PERFORMANCE OF TASK:

Pipe securely supported, aligned, cut the proper length and placed in proper location.

SOURCE OF STANDARD: V-TECS: Plumber, 1984, p. 39

CONDITIONS FOR PERFORMANCE OF TASK:

Given hangers to support pipe
Standard plumber's tool kit
Plans and specifications
Installation/plumber materials
Work order

PERFORMANCE GUIDE:

1. Read plans and specifications to identify type of hanger to be used.
2. Select proper tools and equip jobsite with them.
3. Install hangers according to manufacturer's design.
4. Check hangers to make certain pipes are securely and properly installed.

COMPETENCY: 8 Install a water distribution line to meet local plumbing code

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PERFORMANCE OBJECTIVE 8.12

TASK: Install hot water storage tanks.

STANDARD OF PERFORMANCE OF TASK:

Task complete within two hours.
Plumbing terminals and connectors visible and accessible.
Hot and cold supply lines and hot output connected to proper points.
No leaks in installation.
Electrical and/or gas connections correctly made.
Thermostat functions as specified.
Pressure/temperature relief valve installed.
Installation complies with requirements of governing specifications and codes.

SOURCE OF STANDARD: Writing team
Mechanical Trades: Residential Plumbing, p. 328

CONDITIONS FOR PERFORMANCE OF TASK:

Manufacturer's specifications and instructions
Plans and specifications
Standard plumber's tool kit
Hot water storage tank
Appropriate fittings and supplies
Valves and connections as specified

PERFORMANCE GUIDE:

1. Read plans and specifications to determine tools required.
2. Equip jobsite with proper tools and storage tank.
3. Mount tank securely using manufacturer's specified hardware.
4. Complete installation using joining method prescribed by type of piping material used.
5. Check all connections for leaks.
6. Clean jobsite, and put away tools.

COMPETENCY: 8 Install a water distribution line to meet local plumbing code

---

PERFORMANCE OBJECTIVE 8.13

TASK: Install meter connectors and bypasses.

STANDARD OF PERFORMANCE OF TASK:

Meter connections and bypass installed at proper location per plans and specifications.

Installation complies with governing specifications and codes.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Standard plumber's tool kit
Structure to receive meter connectors and bypasses
Installation/plumbing materials
Meter connector and bypass

PERFORMANCE GUIDE:

1. Read plans and specifications to determine location of fixtures to be installed.
2. Have appropriate tools at jobsite.
3. Select and equip job with proper fixtures.
4. Install connectors and bypasses with proper method of joining pipe; copper, galvanized steel or black iron.
5. Check all connections for leaks.
6. Clean work area, and put away tools.

COMPETENCY: 8 Install a water distribution line to meet local plumbing code

---

PERFORMANCE OBJECTIVE 8.14

TASK: Install outside hose bibbs.

STANDARD OF PERFORMANCE OF TASK:

Hose bibbs installed at proper location, per plans and specifications, with no leaks.

Installation complies with governing specifications and codes.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Given outside hose bibbs
Plans and specifications
Water distribution line to receive bibbs
Standard plumber's tool kit
Installation/plumbing materials

PERFORMANCE GUIDE:

1. Read plans and specifications to verify location of hose bibbs.
2. Make certain proper tools are at jobsite.
3. Have proper fixtures and piping materials at jobsite.
4. Mount hose bibbs securely as per manufacturer's specifications.
5. Connect fixture to water distribution line.
6. Test connections for leaks.
7. Clean work area, pickup tools.

COMPETENCY: 8 Install a water distribution line to meet local plumbing code

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PERFORMANCE OBJECTIVE 8.15

TASK: Install pressure relief valves.

STANDARD OF PERFORMANCE OF TASK:

Pressure relief valve installed at proper location per plans and specifications.

Minimum temperature and settings comply with governing specifications and codes.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Standard plumber's tool kit
Pressure relief valve
Installation/plumbing materials
Work order

PERFORMANCE GUIDE:

1. Hook pressure gauge to outside faucet or laundry tray faucet.
2. Turn on cold water.
3. Check pressure on gauge.
4. Flush toilet.
5. Check pressure gauge.
6. Lossen lock nut and adjust pressure.
7. Check pressure gauge.
8. Tighten lock nut when pressure is adjusted to desired water pressure.
9. Remove gauge.
10. Check to see that the water system is reduced to a predetermined house water pressure.

COMPETENCY: 8 Install a water distribution line to meet local plumbing code

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PERFORMANCE OBJECTIVE 8.16

TASK: Install protective devices to eliminate shock waves and noise.

STANDARD OF PERFORMANCE OF TASK:

Protective shock/noise devices installed at proper location per plans and specifications.

Installation complies with governing specifications and codes.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Standard plumber's tool kit
Shock/noise eliminators
Installation/plumbing materials
Local Plumbing Code

PERFORMANCE GUIDE:

1. Read plans and specifications to determine proper device to be installed.
2. Make certain proper tools and materials are at jobsite.
3. Unpack devices and check for missing parts.
4. Install all devices necessary using proper fittings and joining methods.
5. Check all connections for leaks.
6. Check devices by using water pressure test.
7. Pick up tools.
8. Clean work area.

COMPETENCY: 8 Install a water distribution line to meet local plumbing code

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PERFORMANCE OBJECTIVE 8.17

TASK: Install water service pipes from tanks or pumps to meter connections.

STANDARD OF PERFORMANCE OF TASK:

Water service pipes installed at proper location per plans and specifications.

Installation complies with governing specifications and codes.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Standard plumber's tool box
Installation/plumbing materials
Water service pipes
Previously installed tank/pump and meter
Local Plumbing Code

PERFORMANCE GUIDE:

1. Read plans and specifications to determine materials needed.
2. Select proper tools and have them at jobsite.
3. Have proper pipe fittings and pipe materials at jobsite.
4. Install necessary fittings and pipe to complete hookup of tanks and pumps to meter connections.
5. Test all connections for leaks.
6. Pick up tools and clean work area.

COMPETENCY: 8 Install a water distribution line to meet local plumbing code

---

PERFORMANCE OBJECTIVE 8.18

TASK: Make water pressure tests on water supply systems.

STANDARD OF PERFORMANCE OF TASK:

Tests performed at proper time in sequence of construction and demonstrated to building before enclosure of systems to be tested.

Air flushed from system and water filled.

Gauges must indicate no leaks at prescribed pressure for prescribed length of time in compliance with governing specifications and codes.

SOURCE OF STANDARD: Writing team

Plumbing Installation and Design, 1978, Chapter 11 (Ripka)

CONDITIONS FOR PERFORMANCE OF TASK:

Roughed-in water supply system
Standard plumber's tool kit
Air compressor, hand pump or pressured water source
Materials and devices to close all inlets and outlets of system
Test gauge assembly
Local Plumbing Code

PERFORMANCE GUIDE:

1. Read plans and specifications to determine maximum pressure required of system.
2. Assemble proper tools, gauges, and pumps needed to complete test at jobsite.
3. Apply test required by specifications.
4. Check for leaks and defective fittings.
5. Pickup tools and test equipment.
6. Clean work area.

COMPETENCY: 8 Install a water distribution line to met local plumbing code

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PERFORMANCE OBJECTIVE 8.19

TASK: Prepare lines for protection against freezing or heat loss.

STANDARD OF PERFORMANCE OF TASK:

All areas of pipe and fittings covered with insulation per work order, and plans and specifications.

SOURCE OF STANDARD: V-TECS: Plumbing, 1984, p. 47

CONDITIONS FOR PERFORMANCE OF TASK:

Given lines for protection
Standard plumber's tool kit
Installation/plumbing materials
Plans and specifications
Work orders

PERFORMANCE GUIDE:

1. Solder one end of pipe to fittings.
2. Slide insulation over pipe, cutting to desired length.
3. Force insulation further on to pipe leaving end of pipe bare, and clamp insulation with vise grips.
4. Solder next fitting on pipe.
5. After pipe cools, release insulation and form around fitting, splitting insulation only where necessary and gluing with rubber cement.
6. Check that all areas of pipe and fittings are covered.
7. Repeat process with next section of pipe.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.1

TASK: Install bathtub.

STANDARD OF PERFORMANCE OF TASK:

Backing installed so tub is level and symmetrically placed.
If tub made from enameled steel, secure the tub to rear studs with shingle nails.
Tub should rest on ledge and floor.
Tub covered with protective material.

SOURCE OF STANDARD:
Plumbing Installation & Design -- Chapter 10
Mid America Residential Plumbing -- Part 1

CONDITIONS FOR PERFORMANCE OF TASK:

Rough-in completed
Standard plumber's tool kit
Bathtub
Tub waste and overflow assembly
Trap
Appropriate backing lumber
Protection material
Appropriate fasteners

PERFORMANCE GUIDE:

1. Gather tool kit and equipment and take to work site.
2. Sweep out tub space.
   Note: All trash should be removed and the floor made clean and smooth.
3. Uncrate tub being careful not to scratch or mark.
4. Determine distance from floor to the underside of the rear ledge.
5. Pencil mark this distance on each end of stud on the back wall.
   Note: Measure vertically, from the subfloor.
6. Cut 1" X 4" lumber to support run of tub on back side.
7. Nail 1" X 4" lumber across studs, using the pencil mark as the upper ledge.
8. Bring tub into position and rest rear ledge on the 1" X 4" support.
9. Level the tub (width and length) using vinyl shims.
   Note: Tub should rest firmly on the ledge and the floor.
10. Secure tub to the rear studs with appropriate fasteners.
11. Cover tub with protective materials.
12. Clean up area and put tools away.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.2

TASK: Install shower.

STANDARD OF PERFORMANCE OF TASK:

Fastener should be tight and applied without damage to fixture.

Fixture to be level and plumb, securely mounted to wall and operate normally without leaks.

Shower stall covered with protective covering.

SOURCE OF STANDARD:

CONDITIONS FOR PERFORMANCE OF TASK:

Rough-in completed
Standard plumber's tool kit
Shower unit
Appropriate shower overflows
Shims
Local Plumbing Code
Trap
Protective material
Appropriate shower faucets
Appropriate fasteners
Strap wrench

PERFORMANCE GUIDE:

1. Take tool kit and equipment to worksite.
2. Sweep out space for location of shower stall.
3. Uncrate shower enclosure.
4. Check location for shower enclosure to make sure backing is in place.
   Note: Backing should support upper edge of enclosure on three sides.
5. Bring shower enclosure into position.
6. Level enclosure in both directions.
7. Secure enclosure with appropriate fasteners.
8. Cover enclosure with protective materials.
9. Clean up area and put tools away.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.3

TASK: Install water closet.

STANDARD OF PERFORMANCE OF TASK:

Water closet must operate normally without leaks.
Level and anchored securely without any movement of fixture.

SOURCE OF STANDARD:

Plumbing Installation & Design -- Chapter 10
Mid America Residential Plumbing -- Part 1

CONDITIONS FOR PERFORMANCE OF TASK:

Existing rough-in piping
Standard plumber's tool kit
Level shims
Rag
Local Plumbing Code
Water closet
Putty
Wax ring
Closet bolts and caps

PERFORMANCE GUIDE:

1. Clean closet flange and floor in the immediate area with a rag.
2. Insert closet bolts in flange with threads up.
3. Press wax sealing ring in place on bottom of closet bowl.
4. Set bowl over flange allowing bolts to protrude through holes in bottom of bowl.
5. Press bowl down to seal wax ring.
6. Level bowl using lead shims.
7. Tighten closet bolts, cutting off excess bolt with hack saw.
8. Attach closet tank on bowl using seal provided and tank bolts.
9. Connect water pipe and seat.
10. Check that water closet is operating normally without leaks.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.4

TASK: Install bidets.

STANDARD OF PERFORMANCE OF TASK:

Bidet must operate normally without leaks.
Level and anchored securely without movement.
Fittings must not be scarred.

SOURCE OF STANDARD:

CONDITIONS FOR PERFORMANCE OF TASK:

- Existing rough-in piping
- Standard plumber's tool kit
- Lead shims
- Rag
- Local Plumbing Code
- Bidet
- Putty
- Wax ring
- Bidet bolts and caps

PERFORMANCE GUIDE:

1. Clean bidet flange and floor in the immediate area with a rag and broom.
2. Insert bidet bolts in flange with threads up and exposed.
3. Press wax sealing ring in place on bottom of bidet.
4. Attach faucet assembly to fixture.
5. Set fixture over flange allowing bolts to protrude through holes in fixture.
6. Apply pressure to fixture to seal wax ring.
7. Level fixture using lead shims.
8. Tighten bidet bolts and cut off excess.
9. Connect water supply.
10. Check to see that the bidet is operating properly without leaks.
11. Clean up tools and materials.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.5

TASK: Install fixture backings or concealed supports.

STANDARD OF PERFORMANCE OF TASK:

Backing boards must be securely anchored and properly placed +- 1/8".

Carriers/supports installed according to the "rough-in" dimensions provided by fixture manufacturer (+- 1/16").

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 10

CONDITIONS FOR PERFORMANCE OF TASK:

Appropriate backing lumber (2X6)
Standard plumber's tool kit
Appropriate fasteners
Appropriate fixture carriers/supports
Local Plumbing Code
Power saw
Power drill and bits

PERFORMANCE GUIDE:

1. Select a center line of lavatory location.
2. Cut a 2" X 6" board long enough to reach between 2 studs on either side.
3. Determine the height of the bracket.
4. Nail 2" X 6" boards between studs at this level.
5. Board should be made flush with fixture side of rough wall.
6. Check that boards are sturdy and properly placed.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.6

TASK: Install lavatory.

STANDARD OF PERFORMANCE OF TASK:

Lavatory must be at correct height and level.
Securely mounted in vanity case body and must not leak.
Water must drain freely.
Fittings and faucets must not be scarred.

SOURCE OF STANDARD:
Mid America Residential Plumbing -- Part 1
V-TECS: Plumber

CONDITIONS FOR PERFORMANCE OF TASK:

Standard Plumber's tool kit
Lavatory(ies)
Rough-in piping
"P" - traps
Teflon tape to seal supplies
Local Plumbing Code
Plumbers putty
Sabre saw
Power drill and drill bits
Faucets

PERFORMANCE GUIDE:

1. Remove lavatory from crate if necessary and inspect for damage.
2. Determine the height of installation.
3. Install lavatory hanger at correct height.
4. Connect lavatory faucets. Use plumbers putty between underside of faucet and surface of lavatory.
5. Using nuts and washers supplied by manufacturers, tighten faucets snugly on lavatory.
6. Remove flange from drain plug and coat underside with plumber putty.
7. Drop drain plug flanges into lavatory drain hole.
8. Using material furnished by the manufacturer, tighten drain plug to lavatory.
9. Secure lavatory on hanger previously installed.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.6 continued

TASK: Install lavatory.

PERFORMANCE GUIDE continued:

10. Using lavatory stops and supply fittings, install hot and cold water supplies to lavatory.
11. Install P trap from lavatory drain to drain outlet in wall.
12. Turn on water to lavatory and check water lines and drain lines for leaks.
13. Check that the lavatory is at the correct height, level, securely mounted on the wall and does not leak.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.7

TASK: Install kitchen sink.

STANDARD OF PERFORMANCE OF TASK:

Kitchen sink must be level and securely mounted in cabinet base.
Kitchen sink must not leak with water draining freely.
Fittings and faucets must not be scarred.

SOURCE OF STANDARD:
Mid America Residential Plumbing -- Part 1
V-TECS: Plumber .

CONDITIONS FOR PERFORMANCE OF TASK:

Standard plumber's tool kit
Kitchen sink
Rough-in piping
"P" - trap and connecting waste
Faucets
Local Plumbing Code
Plumber's putty
Sabre saw
Power drills and bits
Teflon tape

PERFORMANCE GUIDE:

1. Take tools, equipment and fixture to job sites.
2. Install kitchen sink faucet.
3. Install sink into counter top and secure with fasteners.
4. Remove continuous waste from carton.
5. Check for missing parts.
6. Place washers on top of flanges, connect tailpieces to basket strainers.
   Note: Slip nuts should be provided on the strainers.
7. Assemble (hand tight) trap and insert in waste pipe drain.
8. Connect (hand tight) continuous waste T to tailpiece nearest the trap.
9. Connect (hand tight) continuous waste extension drain to other tailpiece.
10. Mark extension piece to fit T socket and cut with tubing cutters.
11. Apply pipe dope on continuous waste tailpiece and screw into bottom of T.
12. Swing trap around to connect tailpiece, but do not connect.
13. Cut trap to correct length.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.7 continued

TASK: Install kitchen sink.

PERFORMANCE GUIDE continued:

14. Remove trap and continuous waste and disassemble.
15. Apply small amount of pipe dope to all threaded parts and reassemble.
16. Connect trap to continuous waste tailpiece and then connect trap to waste pipe drain.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.8

TASK: Install traps.

STANDARD OF PERFORMANCE OF TASK:

Trap and fittings must not be scarred.
Trap to pass standard water test.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 10

CONDITIONS FOR PERFORMANCE OF TASK:

Rough-in plumbing
Standard plumber's tool kit
Fixture in drain to be trapped
Trap to be installed
Local Plumbing Code

PERFORMANCE GUIDE:

1. Secure tools and equipment necessary for job.
2. Open trap carton and inspect for missing parts.
3. Place slip nut and washer on drain tailpiece.
4. Place a small amount of pipe dope on the threads of the "p trap" and attach to tailpiece slip nut.
5. Cut off ABS drainpipe close to wall and cement on the male adaptor.
6. Measure the distance from the trap to the ABS adapter and cut trap discharge 2" longer than the measurement.
7. Apply pipe compound and make final connections.
8. Clean up area.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.9

TASK: Install dishwashers.

STANDARD OF PERFORMANCE OF TASK:

Dishwasher must be secure, level and operate through a cycle without leaking.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 10
V-TECS: Plumber

CONDITIONS FOR PERFORMANCE OF TASK:

Dishwasher and accessories
Drop light
Electric drills and drill bits
Standard plumber's tool kit
Local Plumbing Code
Torch
Solder and flux
Plans and specifications

PERFORMANCE GUIDE:

1. Slide the dishwasher in cabinet place.
2. Level and plumb dishwasher.
3. Install screws in top front to secure dishwasher.
4. Drill two holes in rear side of sink cabinet for water supply and discharge hose.
5. Connect hot water supply from under sink to supply inlet on dishwasher with shut off valve under sink.
6. Install air gap in sink top.
7. Install 5/8 in. hose from dishwasher to air gap.
8. Install 7/8 in. hose from air gap to disposal or sink drain.
9. Use hose clamps on all rubber hose.
10. Connect electric supply (provided).
11. Turn water on (check for leaks).
12. Turn electric circuit on.
13. Run dishwasher through a complete cycle and check for leaks.
14. Check that the dishwasher is secure, level and operates through a cycle without leaking.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.10

TASK: Install utility or commercial sinks.

STANDARD OF PERFORMANCE OF TASK:

Installed level, securely mounted and must not leak.

No scratches, chips or cracks in fixture or supply and drain connections.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 10

CONDITIONS FOR PERFORMANCE OF TASK:

Rough-in piping
Standard plumber's tool kit
Specified sink and accessories
Faucets
Torch, solder, flux
Plans and specifications

PERFORMANCE GUIDE:

1. Take tools, equipment and fixtures to job site.
2. Remove utility sink from carton and check for damage or missing parts.
3. Install faucet assembly on utility sink
4. Mount utility sink to wall or secure in place according to specifications.
5. Connect trap and continuous waste assembly.
6. Connect water supply lines.
7. Check to see that utility sink is operating properly without leaks.
8. Clean up tools and area.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.11

TASK: Install drinking fountains.

STANDARD OF PERFORMANCE OF TASK:

Fixture installed with no scratches, chips or cracks.
Supply and drainage to be water tight when tested.

SOURCE OF STANDARD:

Plumbing Installation and Design - Chapter 10

CONDITIONS FOR PERFORMANCE OF TASK:

Rough-in piping
Standard plumber's tool kit
Plans and specifications
Specified fixture
Torch, solder, flux

PERFORMANCE GUIDE:

1. Take tools, equipment and drinking fountain to job site.
2. Remove drinking fountain from carton and check for damage or missing parts.
3. Mount fixture to wall or position on floor.
   Note: Mouth protector must be provided over the nozzle. Drinking water must be delivered at angle to prevent water falling back on the nozzle.
4. Join waste to drain line.
5. Join water supply line.
   Note: The nozzle must be located above the spill line of the fountain.
6. Check to see if fountain operates properly without leaks.
7. Clean up tools and area.
   Note: Handicapped person -- height 27" at base, 48" frontal clearance.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.12

TASK: Install electric water heaters.

STANDARD OF PERFORMANCE OF TASK:

All parts must be free from damage, and heater must provide hot water and specified temperature without leaking.

SOURCE OF STANDARD:/
Plumbing Installation and Design -- Chapter 10
V-TECS: Plumber

CONDITIONS FOR PERFORMANCE OF TASK:

Specified hot water heater
Electric Rough-in
Rough-in piping
Standard plumber's tool kit
Local Plumbing Code
Drop light
Torch, solder, flux

PERFORMANCE GUIDE:

1. Carry tools, equipment and unit to job site.
2. Remove water heater from the carton.
3. Solder two male adapters onto two 8" pieces of 3/4" copper tubing.
4. Apply pipe compound to threaded portion of relief valve and install.
5. Install tubing from relief valve according to local code.
6. Postion heater in proper location.
7. Apply pipe compound/tape to male adapters and install in inlet and outlet openings.
   Note: Check local code for reference to dielectric unions.
8. Clean and flux 3/4" valve and tubing ends protruding from 3/4" male adapters.
9. Install 3/4" valve on cold water inlet tubing.
10. Install tubing and make soldered connections.
    Note: Open valve before soldering.
11. Close drain valve.
12. Open hot water faucet on nearest fixture.
13. Open cold water inlet valve on water heater.
    Note: When water runs freely from fixture faucet, close inlet valve.
14. Check for leaks.

15. Clean up the area and replace tools and equipment.

Con/P

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.13

TASK: Install urinals.

STANDARD OF PERFORMANCE OF TASK:

Urinals must be level and free from damage and meet all pertinent local codes.

No chips, cracks or scratches in fixture or waste and supply

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 10

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications	Rough-in piping
Specified urinals and accessories	Torch, solder and flux
Standard plumber's tool kit	Flush valve
Local Plumbing Code	

PERFORMANCE GUIDE:

1. Take tools, equipment and urinal to job site.
2. Remove urinal from carton and inspect for damage or missing parts.
3. Mount urinal in place according to local plumbing code and rough-in measurements of manufacturer.
4. Mount trap and connect to waste line.
5. Connect cold water supply line.
6. Check to see that urinal is operating properly without leaks.
7. Clean up tools and area.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.14

TASK: Install garbage disposal units.

STANDARD OF PERFORMANCE OF TASK:

Disposal must operate properly without leaks.
Fittings must not be scarred.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 10

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Plumbing rough-in piping
Standard plumber's tool kit
Specified garbage disposal
Electric circuit tester
Local Plumbing Code
Strap wrench
Catch pan
Putty
Drop light

PERFORMANCE GUIDE:

1. Remove "P" trap and catch water.
2. Remove old basket strainer.
3. Clean sink opening.
4. Install disposal head (using plumber's putty).
5. Connect electric wires to disposal.
6. Put tailpiece on disposal (supplied).
7. Remove 1-1/2" nipple from wall.
8. Install disposal on mounting ring.
9. Install proper size nipple to match disposal drain to "P" trap.
10. Install P-trap and tighten.
11. Tighten mounting ring on disposal.
12. Turn water on (check for leaks).
13. Turn electric switch on with water running.
14. Fill sink to check for pressure leaks.
15. Check that disposal operates properly without leaks.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.15

TASK: Install gas water heaters.

STANDARD OF PERFORMANCE OF TASK:

1. Main burner must ignite and extinguish as thermostate indicates.
2. Pilot or pilot generator must continue to burn without manually holding down reset button.
3. Gas piping must pass leak test for local code (soapy water).
4. All parts must be free from damage, and heater must provide hot water without leaking.

SOURCE OF STANDARD: Plumbing Installation and Design -- Chapter 10

CONDITIONS FOR PERFORMANCE OF TASK:

Supply and distribution system for hot water
Gas fittings and connections
Standard plumber's tool kit
Gas hot water heater
Electric outlet
Local Plumbing Code
Torch, solder, flux
Teflon tape
Drop light
Joint compound

PERFORMANCE GUIDE:

1. Locate relief valve outlet on water heater.
2. Install relief valve.
3. Attach 3/4" approved line from relief valve to location of desired overflow.
   Note: End of line must not be threaded.
4. Use nipple, elbow and union to install 3/4" galvanized line from heater to hot water supply line.
5. Use 3" vent pipe and run vent into chimney.
6. Use black iron pipe and fittings and connect gas line to heater.
7. Turn gas supply on and check for leaks, use soap and water solution as a leak detector.
8. Open hot water faucet in kitchen sink.
9. Turn water supply on.
10. Fill hot water tank until water flows from hot water faucet in kitchen sink.
11. Light and adjust burner.
12. Clean up area and return tools to proper place.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.16

TASK: Install laundry tubs.

STANDARD OF PERFORMANCE OF TASK:

Installed laundry tubs must be level, securely mounted and free of leaks.

There must be no scratches, chips or cracks in fixture, supply or drain connector.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 10

CONDITIONS FOR PERFORMANCE OF TASK:

Rough-in piping
Standard plumber's tool kit
Plans and specifications
Specified laundry tubs and accessories
Local Plumbing Code
Faucets
Torch, solder, flux

PERFORMANCE GUIDE:

1. Transport tools, equipment and fixture to job site.
2. Install faucet assembly on laundry tubs.
3. Mount utility sink to wall or secure in place according to manufacturer's specifications.
4. Connect trap and wast assembly.
5. Connect water supply lines.
6. Check to see that laundry tubs are operating properly without leaks.
7. Clean up tools and area.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.17

TASK: Install faucets.

STANDARD OF PERFORMANCE OF TASK:

No scratches on fixture finish.
Piping is water tight when tested.
Faucet should not be scarred.

SOURCE OF STANDARD:

Plumbing Installation and Design -- Chapter 10
Mechanical Trades - Residential Plumber

CONDITIONS FOR PERFORMANCE OF TASK:

Fixture in place
Standard plumber's tool kit
Faucet, seals and accessories
Local Plumbing Code
Plumbers putty
Torch, solder, flux

PERFORMANCE GUIDE:

1. Transport tools and equipment to job site.
2. Take faucet out of package and check for damage or missing parts.
3. Apply putty to base of faucet escutcheon.
4. Place rubber washer on base of faucet.
5. Insert faucet into sink holes.
6. Place metal washers and nuts on faucet shanks and tighten with spanner wrench.
   Note: Check that faucet is straight on the sink.
7. Clean up tools and area.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.18

TASK: Apply protective coverings to bathtubs for abrasion protection.

STANDARD OF PERFORMANCE OF TASK:

Fixture must be completely covered to adequately protect unit during all phases of construction.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Fixture installed in place
Appropriate adhesive
Standard plumber's tool kit
Manufacturer's protective covering or cardboard or newspaper
Local Plumbing Code

PERFORMANCE GUIDE:

1. Use cardboard carton from bathtub to prepare protective covering.
2. Wipe bathtub clean with a damp cloth.
3. Place protective covering in place and secure with duct tape.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.19

TASK: Install pre-heat tanks for hot water systems.

STANDARD OF PERFORMANCE OF TASK:

Tanks installed with +- 15 degrees of true south exposure, 9 a.m. to 3 p.m. unobstructed.

Mounting system capable of supporting full tank assembly without damage to substructure.

No leaks in plumbing connections.

Plumbing interface to existing hot water in compliance with local plumbing codes.

SOURCE OF STANDARD:

Solarizing Your Present Home -- Unit 3

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Standard plumber's tool kit
Carpenters tools as need per mounting system
Preheat tank assembly
Local Plumbing Code

PERFORMANCE GUIDE:

1. Locate for maximum (A) orientation to true south +- 15 degrees, (B) unobstructed exposure to year round sun 9 a.m. to 3 p.m. (minimum), (C) proximity to cold water feed to conventional hot water heater.
2. Shut off water to building.
3. Cut into cold water feed to hot water heater.
4. Install a shut off valve (for preheat tank bypass) with tees on both ends for preheater loop so that valve handle is accessible from inside building.
5. Extend and join pipe from tees to building exterior.
6. Construct mounting system for preheat tank.
7. Mount preheat tank.
8. Connect preheat tank plumbing to preheat tank loop extensions with a shut off valve on each extension for drain operation.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.19 continued

TASK: Install pre-heat tanks for hot water systems.

PERFORMANCE GUIDE:

9. Turn on building water and test for leaks, valve and drain operations.
10. Insulate pipe runs exposed.
11. Seal/repair wall penetrations.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.20

TASK: Install solar hot water systems.

STANDARD OF PERFORMANCE OF TASK:

Collectors mounted at angle of latitude +- 10 degrees and oriented within 15 degrees of true south, unobstructed between 9 a.m. and 3 p.m.

Plumbing system as per manufacturer's specification and in accordance with Uniform Plumbing Code with no leaks.

System functions properly to heat water and freeze protection features are adequate for local climate.

SOURCE OF STANDARD:
Installation Guidelines for Solar DHW Systems, pp. 82-90

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Manufacturer's instructions
Standard plumber's tool kit
Pipe insulation
Thermostatic senders
Sufficient copper pipe as per installation
Fittings, valves and other miscellaneous devices
Local Plumbing Code
Solar collector(s)
Solar hot water tank
Pump(s)
Controllers

PERFORMANCE GUIDE:

1. Install additional solar hot water tank (2 tank systems) or replace conventional hot water with solar/conventional heat source combined tank (1 tank systems) as per manufacturer's instructions.
2. Locate collectors for maximum (A) orientation to true south +- 15 degrees, (B) unobstructed exposure to year round solar exposure 9 a.m. to 3 p.m. (minimum), (C) proximity to location of storage tank(s).
3. Make wall/ceiling/roof penetrations as appropriate for plumbing and wiring runs.
4. Mount collectors as per governing codes and manufacturer's instructions.
5. Rough in and connect all plumbing runs as per plans or instructions.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.20 continued

TASK: Install solar hot water systems.

PERFORMANCE GUIDE continued:

6. Install sensor wiring to collectors.
7. Seal roof penetrations for no leaks.
8. Install pumps, valves, and other devices as per manufacturer's instructions.
9. Install controller as per manufacturer's instructions.
10. Check all system components for mechanical, electrical, and plumbing integrity.
11. Fill system and check for leaks.
12. Check system for drain operation (not for closed loop antifreeze type systems).
13. Turn filled system on (sunny day) and inspect for proper operation.

COMPETENCY: 9 Install plumbing fixtures and equipment to meet local plumbing code

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PERFORMANCE OBJECTIVE 9.21

TASK: Install gas vents for appliances.

STANDARD OF PERFORMANCE OF TASK:

Installation shall properly exhaust waste gases with no gas odor detectable.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Existing outlet for vent
Standard plumber's tool kit
Appropriate sheet metal tools
Local Plumbing Code
Venting sheet metal
Pipes and connector

PERFORMANCE GUIDE:

1. Transport tools and vent to job site.
2. Cut appropriate holes for vent.
3. Install vent piping and secure in place.
4. Apply appropriate flashing.
5. Clean up tools and area.

COMPETENCY: 10 Perform miscellaneous activities to complete job with customer satisfaction

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PERFORMANCE OBJECTIVE 10.1

TASK: Clean work areas.

STANDARD OF PERFORMANCE OF TASK:

Work area appropriately cleaned, as determined by job supervisor.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Given work area
Examples of properly cleaned stations

PERFORMANCE GUIDE:

COMPETENCY: 10 Perform miscellaneous activities to complete job with customer satisfaction

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PERFORMANCE OBJECTIVE 10.2

TASK: Correct hazards.

STANDARD OF PERFORMANCE OF TASK:

Hazard is removed or corrected as appropriate and to satisfaction of supervisor and customer.

If hazard is temporarily uncorrectable warnings are posted.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Given hazard needing correction
Standard plumber's tool kit

PERFORMANCE GUIDE:

COMPETENCY: 10 Perform miscellaneous activities to complete job with customer satisfaction

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PERFORMANCE OBJECTIVE 10.3

TASK: Instruct owners/users regarding manufacturer's instructions and warrantees.

STANDARD OF PERFORMANCE OF TASK:

Owner/users are provided with instruction and warranty information for all plumbing and plumbing-related devices.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Manufacturer's instructions and warranties
Owner's/users presence
Devices needing operation instructions or warranty explanations

PERFORMANCE GUIDE:

COMPETENCY: 10 Perform miscellaneous activities to complete job with customer satisfaction

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PERFORMANCE OBJECTIVE 10.4

TASK: Perform final cleanup.

STANDARD OF PERFORMANCE OF TASK:

All plumber related materials removed per cleanup specifications.

Plumber related installations all have properly cleaned surfaces.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Job site to be cleaned
Removal of tools and equipment
Contract site cleanup specifications

PERFORMANCE GUIDE:

COMPETENCY: 10 Perform miscellaneous activities to complete job with customer satisfaction

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PERFORMANCE OBJECTIVE 10.5

TASK: Prepare installations for final inspection.

STANDARD OF PERFORMANCE OF TASK:

Drain/Waste/Vent System

All plumbing fixtures set and traps filled with water.
All stack openings plugged.
Building drain plugged at front main cleanout.
Manometer hose inserted through the trap seal of a water closet and any water blown out of hose, then refilled to zero mark.
Other hose inserted through same trap seal to introduce sufficient air pressure for one-inch pressure differential.

Water supply and distribution system

All air flushed from systems, openings sealed.
Hydrostatic test pump attached to system with no leaks.
Pressure gauge appropriately installed.

SOURCE OF STANDARD:

Plumbing Installation and Design, Chapter 11, 1978 (Ripka)

CONDITIONS FOR PERFORMANCE OF TASK:

Completed installations for final inspection
Standard plumber's tool kit
Water source
Air pressure source
Manometer and/or hydrostatic test pump with pressure gauge
Materials/devices to close all inlets and outlets of system

PERFORMANCE GUIDE:

COMPETENCY: 10 Perform miscellaneous activities to complete job with customer satisfaction

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PERFORMANCE OBJECTIVE 10.6

TASK: Provide identification of systems such as color coding or special markings.

STANDARD OF PERFORMANCE OF TASK:

Marked sketch where hot/cold water sources are located, main shut-off valve, water meter, and all drain openings.

Optional marked sketch for gas main, with shut-off and outlets.

SOURCE OF STANDARD: Uniform Plumbing Code
ASTM

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Given a plumbing system sketch

PERFORMANCE GUIDE:

COMPETENCY: 10 Perform miscellaneous activities to complete job with customer satisfaction

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PERFORMANCE OBJECTIVE 10.7

TASK: Test all connections for leaks.

STANDARD OF PERFORMANCE OF TASK:

Tests performed at proper time in sequence of construction and demonstrated to building inspector before enclosure of lines to be tested.

Systems must be pressurized according to governing codes and specifications.

Gauges must indicate no leaks at prescribed air pressure or water head prescribed for specifications.

Gauges must indicate no leaks at prescribed air pressure or water head for prescribed length of time.

SOURCE OF STANDARD:

Plumbing Installation and Design, Chapter 11 (Ripka)

CONDITIONS FOR PERFORMANCE OF TASK:

Completely roughed-in plumbing system
Standard plumber's tool kit
Air compressor, hand pump, for water source
Materials to close all inlets and outlets of system
Test gauge assembly
Soap solution to check for leaks

PERFORMANCE GUIDE:

COMPETENCY: 10 Perform miscellaneous activities to complete job with customer satisfaction

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PERFORMANCE OBJECTIVE 10.8

TASK: Test completed installations.

STANDARD OF PERFORMANCE OF TASK:

Water supply and distribution piping test demonstrates no leaks in system for testing period required by governing specifications, codes and authority.

Drain/waste/vent system demonstrates no leaks in system for testing period required by governing specifications, codes and authority.

SOURCE OF STANDARD:

Plumbing Installation and Design, Chapter 11 (Ripka)

CONDITIONS FOR PERFORMANCE OF TASK:

Completed plumbing system installed
Testing equipment and setups completed as per performance objective, A 13.5 "Prepare installations for final inspection"
Presence of building inspector to sign off completed tests

PERFORMANCE GUIDE:

Water test - water distribution system:

1. Fill pipes being tested completely with portable water after sealing all openings.
2. Extend suction end of pump to container of portable water, connect discharge end to test gauge assembly.
3. Stroke pump handle to force enough water into system to raise pressure within system to require pressure for test.
4. If gauge does not hold steady, air pockets are indicated and further flushing is necessary before repeating the procedure.
5. Check that the water distribution system does not leak at prescribed pressure for prescribed length of time as per local codes.

COMPETENCY: 10 Perform miscellaneous activities to complete job with customer satisfaction

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PERFORMANCE OBJECTIVE 10.8 continued

TASK: Test completed installations.

PERFORMANCE GUIDE continued:

Water test building drains:

1. Cap the main sewer line outside the house with a test plug and drain.
2. Cap all the open ends of the drain lines.
3. Fill the system with water.
4. Check for leaks.
5. After testing, drain the system into a sewer ditch.
6. Check the drain system for water-tightness.

Pressure test gas lines:

1. Cap all outlets.
2. Install mercury or Kuhlmann gauge in an outlet.
3. Pressurize as per code; observe for prescribed length of time.
4. Check that systems are pressurized according to local codes and the gauges indicate no leaking at presented pressures for prescribed lengths of time.

Locate gas leaks using soapy water:

1. Mix small amount of water and soap in a small cup or can.
2. Whip mixture into lather.
3. Apply lather to all pipe joints and fittings.
4. Carefully inspect each joint and fitting for either very small bubbles or a single large bubble identifying and locating leak.
5. If no leak shows, repeat operation again.
6. Check:
   a. All joints and fittings.
   b. To see that all soap and water has been wiped off.
   c. To see that gas odor is dissipated.

   CAUTION: Never look for gas leaks with matches or fire of any kind.

7. Check that gas pipe system is free of leaks.

COMPETENCY: 10 Perform miscellaneous activities to complete job with customer satisfaction

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PERFORMANCE OBJECTIVE 10.9

TASK: Winterize systems.

STANDARD OF PERFORMANCE OF TASK:

All exposed pipe wrapped/insulated to proper R-value.

CONDITIONS FOR PERFORMANCE OF TASK:

System to be winterized
Standard plumber's tool kit
Insulation materials

PERFORMANCE GUIDE:

COMPETENCY: 11 Maintain plumbing installations to ensure proper operation

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PERFORMANCE OBJECTIVE 11.1

TASK: Clean traps.

STANDARD OF PERFORMANCE OF TASK:

Trap(s) removed without damage and reassembled without leaks.

SOURCE OF STANDARD: V-TECS: Plumber, 1984, p. 78

CONDITIONS FOR PERFORMANCE OF TASK:

Traps to be cleaned
Standard plumber's tool kit
Equipment for cleanout

PERFORMANCE GUIDE:

1. Place pail under trap.
2. Loosen both lock nuts (upper and lower) allowing water to drop into pail.
3. When water is completely drained, remove trap.
4. After drain is cleared, thoroughly clean both connections.
5. Apply pipe dope to both connections.
6. Hand tighten both nuts.
7. Tighten with wrench.
8. Check to see that trap was removed without damage and reassembled without leaks.

COMPETENCY: 11 Maintain plumbing installations to ensure proper operation

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PERFORMANCE OBJECTIVE 11.2

TASK: Drain systems.

STANDARD OF PERFORMANCE OF TASK:

All water purged from system.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Water system to be drained
Standard plumber's tool kit

PERFORMANCE GUIDE:

COMPETENCY: 11 Maintain plumbing installations to ensure proper operation

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PERFORMANCE OBJECTIVE 11.3

TASK: Remove stoppages in drains and sewers.

STANDARD OF PERFORMANCE OF TASK:

Stoppage accurately located and removed so drain system operates freely.

SOURCE OF STANDARD: V-TECS: Plumber, 1984, p. 75-76
Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Drain system containing stoppage
Standard plumber's tool kit
Drain cleaning machine

PERFORMANCE GUIDE:

1. Using large wrench remove clean-out plug.
2. Insert cable from sewer drain cleaning machine into drain.
3. Keep track of the length of cable until obstruction is found.
4. After stoppage is located, determine path of concealed pipe.
5. Measure along the path of the pipe the distance of cable used.
6. Check that obstruction is accurately located.

COMPETENCY: 11 Maintain plumbing installations to ensure proper operation

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PERFORMANCE OBJECTIVE 11.4

TASK: Repair or replace defective faucets.

STANDARD OF PERFORMANCE OF TASK:

Faucet repaired/replaced so free of any drips or leaks and operates smoothly and quiety.

SOURCE OF STANDARD: V-TECS: Plumber, 1984, p. 80

CONDITIONS FOR PERFORMANCE OF TASK:

Given defective faucets
Standard plumber's tool kit
Installation/plumbing materials

PERFORMANCE GUIDE:

1. Observe the condition and determine source, cause and corrective action.
2. Turn off water.
3. Remove handle screw and handle.
4. Remove packing nut completely.
5. Unscrew stem from valve body.
6. Remove bibb screws.
7. Remove washers.
8. Remove retaining cup (if necessary).
9. Remove seat (if necessary).
10. Replace retaining cup (if necessary).
11. Replace seat (if necessary) with same type and size.
12. Replace washer and bibb screw with same type and size.
13. Lubricate stem.
14. Replace packing and/or "O" rings if necessary.
15. Reassemble properly.
16. Turn on water and test complete operation as per standard.
17. Check to make sure faucet is free of any drips or leaks and operates smoothly and quietly.

COMPETENCY: 11 Maintain plumbing installations to ensure proper operation

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PERFORMANCE OBJECTIVE 11.5

TASK: Repair or replace defective fixtures.

STANDARD OF PERFORMANCE OF TASK:

Fixture repaired/replaced so free of any drip or leaks and operates smoothly and quietly.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Given defective fixtures
Standard plumber's tool kit
Installation/plumbing materials

PERFORMANCE GUIDE:

COMPETENCY: 11 Maintain plumbing installations to ensure proper operation

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PERFORMANCE OBJECTIVE 11.6

TASK: Repair or replace defective pipes.

STANDARD OF PERFORMANCE OF TASK:

Defective pipe(s) removed without damage and reassembled without leaks.

SOURCE OF STANDARD: Writing team
V-TECS: Plumber, 1984, p. 78

CONDITIONS FOR PERFORMANCE OF TASK:

Given defective pipe(s)
Standard plumber's tool kit
Replacement plumbing/installation materials

PERFORMANCE GUIDE:

COMPETENCY: 11 Maintain plumbing installations to ensure proper operation

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PERFORMANCE OBJECTIVE 11.7

TASK: Repair or replace defective traps.

STANDARD OF PERFORMANCE OF TASK:

Trap removed without damage and reassembled without leaks.

SOURCE OF STANDARD: Writing team
V-TECS: Plumber, 1984, p. 78

CONDITIONS FOR PERFORMANCE OF TASK:

Given defective trap
Standard plumber's tool kit
Installation/plumbing materials

PERFORMANCE GUIDE:

COMPETENCY: 11 Maintain plumbing installations to ensure proper operation

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PERFORMANCE OBJECTIVE 11.8

TASK: Service manual controls.

STANDARD OF PERFORMANCE OF TASK:

Controls free from dirt and all foreign substances, and operates freely.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Manual control that needs servicing
Standard plumber's tool kit

PERFORMANCE GUIDE:

COMPETENCY: 11 Maintain plumbing installations to ensure proper operation

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PERFORMANCE OBJECTIVE 11.9

TASK: Thaw frozen pipes.

STANDARD OF PERFORMANCE OF TASK:

Water flows through pipe freely.

SOURCE OF STANDARD: V-TECS: Plumber, 1984, p. 83

CONDITIONS FOR PERFORMANCE OF TASK:

Given frozen pipes that need training
Standard plumber's tool kit
Hot air blower
Fire extinguisher
Drop lights
Drop cloth

PERFORMANCE GUIDE:

1. Locate frozen pipes.
2. Open faucet of pipe working on.
3. Apply heat to pipe.
4. Check faucet to see if water is flowing.

COMPETENCY: 11 Maintain plumbing installations to ensure proper operation

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PERFORMANCE OBJECTIVE 11.10

TASK: Locate leaks in water and gas piping.

STANDARD OF PERFORMANCE OF TASK:

Leaks in water piping are located.
Leaks in gas piping are located.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Leaks in water or gas piping
Soapy solution
Brush and can

PERFORMANCE GUIDE:

COMPETENCY: 11 Maintain plumbing installations to ensure proper operation

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PERFORMANCE OBJECTIVE 11.11

TASK: Eliminate odors and noise in plumbing systems.

STANDARD OF PERFORMANCE OF TASK:

All traps cleaned and water flows freely.

Where applicable, air chamber hammer adjusted and operates quietly.

Extreme case, wall penetrated and piping secured, so noise ceases.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Plumbing system that is smelly/noisey
Standard plumber's tool kit
Installation/plumbing materials
Drain cleaning machine

PERFORMANCE GUIDE:

COMPETENCY: 12 Perform records filing and management so records will be located easily

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PERFORMANCE OBJECTIVE 12.1

TASK: Inventory plumbing fixtures, equipment, fittings, and supplies.

STANDARD OF PERFORMANCE OF TASK:

Similar or like materials shall be grouped together on inventory form.

Final quantities shall be rechecked.

SOURCE OF STANDARD: Estimating Plumbing Costs

CONDITIONS FOR PERFORMANCE OF TASK:

Plans and specifications
Supplies and materials list (Inventory list)
Architects scales
Local plumbing code

PERFORMANCE GUIDE:

COMPETENCY: 12 Perform records filing and management so records will be located easily

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PERFORMANCE OBJECTIVE 12.2

TASK: List materials expended on each job.

STANDARD OF PERFORMANCE OF TASK:

Materials and supplies systematically listed.
Similar materials grouped on list.
Final quantities rechecked.

SOURCE OF STANDARD: Estimating Plumbing Costs

CONDITIONS FOR PERFORMANCE OF TASK:

Supplies and materials list
All invoices from job
Accurate daily log of materials used at job site
Calculator

PERFORMANCE GUIDE:

COMPETENCY: 12 Perform records filing and management so records will be located easily

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PERFORMANCE OBJECTIVE 12.3

TASK: List tools procured.

STANDARD OF PERFORMANCE OF TASK:

Records kept in accurate manner so as to update inventory on regular basis.

SOURCE OF STANDARD: Writing team

CONDITIONS FOR PERFORMANCE OF TASK:

Inventory list of tolls on file
Policies and procuedures manual
Purchase orders
Invoices

PERFORMANCE GUIDE:

COMPETENCY: 12 Perform records filing and management so records will be located easily

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PERFORMANCE OBJECTIVE 12.4

TASK: List work performed.

STANDARD OF PERFORMANCE OF TASK:

Work orders completed accurately and kept current.

SOURCE OF STANDARD:

Construction Superintending -- Chapter 3

CONDITIONS FOR PERFORMANCE OF TASK:

Work order forms
Policies and procedures manual

PERFORMANCE GUIDE:

COMPETENCY: 12 Perform records filing and management so records will be located easily

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PERFORMANCE OBJECTIVE 12.5

TASK: Record labor information on time sheets.

STANDARD OF PERFORMANCE OF TASK:

Records completed daily with: Work hours, job duties, or assignment. Maintained without errors of calculation.

SOURCE OF STANDARD:

Construction Contracts -- Chapter 4

CONDITIONS FOR PERFORMANCE OF TASK:

Time cards
Policies and procedures manual

PERFORMANCE GUIDE:

PLUMBER'S STANDARD TOOL KIT

A standard tool kit for a Plumber, as indicated in the Performance Objectives, includes the following tools:

Hard hat
10" pipe wrench
10" crescent
12" spud wrench
1/2" open end box
3/8" ditto
Channel locks
Packing iron
Outside iron
4" ladle
Pair safety glasses
No. 15 cutter
Pack (1) hack saw blades
Chalk box (with line)
9" screwdriver
4" screwdriver
1/2" center punch
Rat-tail file, 8"
Putty knife
Slip joint pliers
Snips

14" pipe wrench
12" crescent
Basin wrench
Socket key set
9/16" ditto
7/16" ditto
6" rule w/extension
Driving iron
No. 2 joint runner
Striker
Hack saw
No. 20 cutter
Plumb bob
16 oz. ball peen hammer
6" screwdriver
12" brick chisel
1/2" round file 8"
Ball string line
Pair imp cutters
6" phillips screwdriver

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PLUMBING MATRIX

		BASIC MATH SKILLS				SCIENCE SKILLS				COMMUNICATION SKILLS				RESPONSIBILITY SKILLS										
PLUMBING COMPETENCIES	PRIMARY REFERENCES FOR COMPETENCIES	Adds, subtracts, multiplies, and divides whole numbers, fractions, and decimals.	Solves algebraic and trigonometric equations.	Demonstrates the use of various units of measurements. For example: area, volume, ratios, proportions.	Estimates material quantities and costs.	Knows basic electrical theory.	Demonstrates knowledge of the properties of fluids. For example: density, viscosity, specific gravity.	Applies principles of static lift, displacement and buoyancy.	Knows various properties of metals and chemicals encountered in plumbing construction.	Communicates effectively both verbally and in writing.	Interprets contract document.	Uses appropriate terminology associated with residential plumbing.	Asks appropriate questions to find or clarify essential building instructions.	Remains current in new plumbing materials and techniques.	Maintains required physical condition.	Acquires and maintains the tools of the trade.	Keeps work area safe and orderly.	Follows instructions and respects authority.	Adapts to changing job conditions, job sites, and work assignments.	Demonstrates a working knowledge of construction techniques of other trades.	Works without close supervision.	Demonstrates pride in qulaity workmanship.	Anticipates problems and avoids them.	Gets along with others.
Apply safety principles for a safe working environment.						●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●
Apply local plumbing code and regulations needed to pass inspection.		●	●	●	●		●		●		●	●	●	●	●			●		●	●	●		
Assemble/demonstrate use & care of tools & equipment needed for plumbing tools.						●			●	●			●	●		●	●					●		●
Perform measurement & calculation for plumbing pipe connections & seals to operate within local plumbing code.		●	●	●	●			●	●	●	●	●	●	●				●	●		●	●	●	●
Interpret drawings and specifications to determine work aids required & sequence of installation.		●		●	●				●	●	●	●	●	●				●		●	●	●	●	●
Perform records filing and management so files can be easily located.		●			●					●		●	●					●			●			●
Demonstrate cutting, threading & assembling pipe to insure gas tight & water tight seals.								●	●	●		●	●	●	●	●	●	●	●		●	●	●	●
Install soil, waste, and vent systems within local code requirements.		●	●	●			●	●	●		●	●	●	●			●	●	●	●	●	●	●	●
Install a water distribution line to meet local plumbing code.		●	●	●			●		●		●	●		●			●	●	●	●	●	●	●	●
Install plumbing fixtures and equipment to meet local plumbing code.		●			●				●		●		●	●			●	●	●	●	●	●	●	
Maintain plumbing installation to ensure proper operation.						●						●	●	●					●		●	●		●
Exhibit worker traits to provide positive working relations.										●		●	●					●		●		●	●	●

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